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Milling Spirals in the Lathe.—Tools for Grooving Cams in the Drill Press.

BY A. H. CLEAVES.

I have worked in shops, particularly in my earlier experience, where, to use an old saw, we had to "make a silk purse out of a sow's ear"; and one of the common practices was to utilize the engine lathe in various ways for a milling machine.

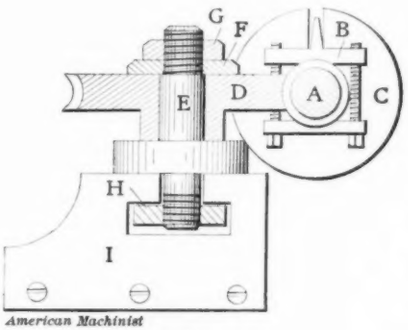

Fig. 1
FIXTURE FOR HOBBING.

Having seen the same practice in vogue in different places in recent years, I will illustrate and describe one or two customs that are apt to be of value almost any time; one of them at least on either a lathe or milling machine:

Fig. 1 shows how a worm-wheel can be hobbed out quite acceptably in the engine lathe. *A* shows a section of a hob running on the lathe centers, *B* the dog, and *C* the face-plate of the lathe.

D is the worm gear or wheel in section; and this revolves on the stud or post *E*. The hob rotates *D* on this stud, and the work moving with the lathe carriage *I* is fed against the hob until the proper depth is reached. *E* has a shoulder at *F*, the washer being brought against it by the nut *G*. Another nut *H* locks the work to the tool-post piece *I* of the lathe, a wrench on *G* tightening both nuts *G* and *H*.

Figs. 2 and 3 explain a very useful tool, and one that is not out of fashion at any time when the styles of work shown in the figures are in demand.

Fig. 2 gives a plan of the fixture with one style of work in position, and Fig. 3 two other samples of product.

In Fig. 2 *A* is a cutter running in the lathe, and *B* is the work; or a piece of metal having a spiral groove to be cut in it to any desired length.

C is a holder or chuck for the work *B*, which allows of making as many pieces like the latter as may be required. The permanent fixture *C* has a thread or groove like *G* or *H*, corresponding with the groove on *B*, of necessity only in pitch. The groove *G* or *H* can be a V shape, as shown, or any other more convenient one, as they act merely as guides for *B* while it is being milled.

I have shown a deep or coarse thread at *G* and the same thread split at *H*. Two or three separate threads like *H*, each of the same pitch as *G*, give the same lead and frequently are found convenient when *G* would be impractical, owing to the size of the screw.

It will be seen that the casting *D* is attached to the lathe with the bolt *E*, which secures it to the tool-post piece *I*, shown in Fig. 1. And when swiveled into position, or at the proper angle for the tool *A* to conform to the pitch on *B*, the whole fixture can be moved in or out in relation to the cutter, in the direction of the dotted line *J*, by using the cross-feed of the lathe. The opening at *K* in the casting *D* is the size of the rod to be cut or grooved, and acts as a rigid rest or support for the same while being milled. The opening at *L* admits the cutter to the work, and *C* being turned by hand carries *B* along the path of operation.

This device has been used to my knowledge on light, delicate work in two shops, in both of which well equipped milling machines with universal heads were in use, but were not considered as convenient for this particular kind of work as the above tool.

Cuts like those on *L*, Fig. 2, and *b*, Fig. 3, were made on a number of steel drill rods, to be used for trepanning purposes by a surgeon, and gave excellent results at a small cost. A cut like *b*, Fig. 3, was made on a ⅛-inch wire, the cut ⅛ inch wide and different depths, one for experiment nearly to 1-32 inch at the center.

A number of winding arbors with groove similar to *c*, Fig. 3, were made

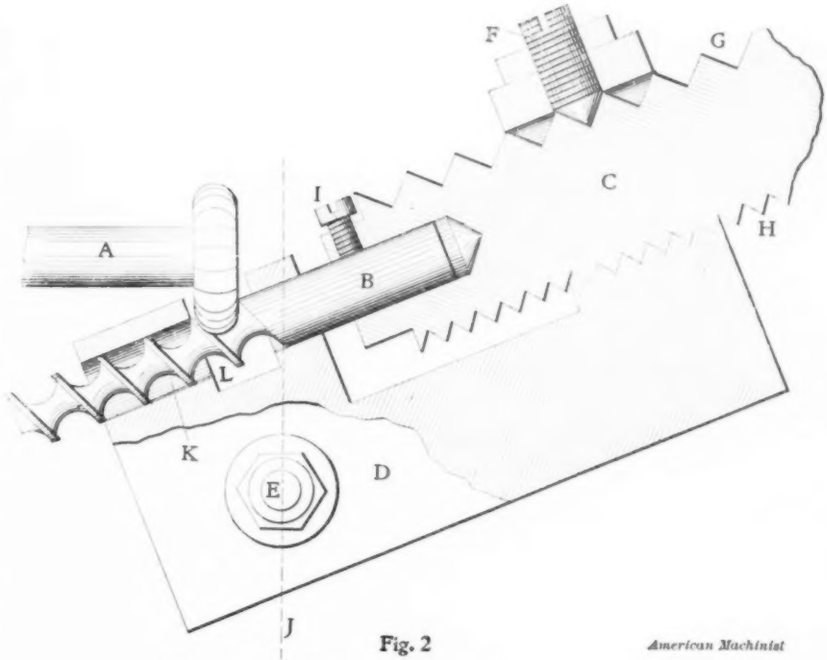

Fig. 2
FIXTURE FOR SPIRAL GROOVING IN THE LATHE.

in another shop for a wire mattress company, and after being once provided for with the tool described, they were produced at short notice as needed.

The first work was got out on a small bench lathe, and the last on a plain milling machine, after the fixture was complete.

Apropos to the foregoing description is another line of work that might be

Fig. 3

SOME OF THE WORK.

called a neighbor-in-law to the above, and which consists in an empirical method of getting spiral and irregular grooves on a cylindrical surface for cams, etc. I had occasion some months since to get a variety of sinks into parts of a gun model, similar to that shown at *A*, Fig. 14, and found most of the tools and methods illustrated in Figs. 4 to 14 very useful.

In Fig. 14 we have a hollow cylinder *B*; say a brass tube, in which it is required to cut two slots like *A* equal and opposite. Take a piece of thin linen writing paper, or any flexible paper, for that matter, and make the distance *B C*, Figs. 12 and 13, equal to the circumference of *B*, Fig. 14.

Then draw the line *F*, Fig. 13, for distances *D* and *E*, or the movement sideways and endways required on the cam. Divide this line into spaces convenient to use some regular size drill rod for drilling and sinking the work. Mark the centers shown by small circles plainly. After the drawing is finished cut it out squarely, as shown by the border lines, roll it around the tube *B*, Fig. 14, carefully, and paste or fasten it to the same in any way thought best.

A line marked on *B*, Fig. 14, while it is revolved in a lathe chuck, will furnish a guide for rolling *A*, Fig. 13, around the same correctly. Then prick punch the centers *g*, *h*, *i*, *j*, *k* through the paper onto the brass tube *B*, Fig. 14, and afterward wash the paper and paste off.

In Figs. 4 and 5 the casting *A* is used as follows: A hole the size of *B* is made the entire length, and two other vertical holes, *G G*, through the center of the former hole. These holes guide the different tools shown in Figs. 6, 7, 8, 9, and at *H*, *I*, *J*, Figs. 4 and 5. For getting the groove *A*, Fig. 14 merely in a tube *B*, a simple block like one end of Fig. 4 will answer.

Place the tube *B* in the block *A*, Fig. 4, and bring the center pin seen in Fig. 9 into one of the prick-punched marks transferred from the paper to the tube through *g*, *h*, *i*, *j*, *k*. Then fasten the tube with the set-screw *K*, Fig. 5, and drill two holes in opposite sides of the tube at one holding, by turning the block *A* over and drilling through *G*. Drill *g*, *h*, *i*, *j*, *k* all in this way, and file the slot *A*, Fig. 14, open, using the holes as a guide.

This gives two openings like *A*, Fig. 14, on opposite sides of the tube, and other shapes, such as that in Fig. 12, etc., can be obtained in the same way. Keep one set of holes, if for profile work, to remove stock when used with *F*, as will be explained.

In the gun work mentioned above the the sinks were to be made in the solid piece *C*, and after drilling the holes *g*, *h*, *i*, *j*, *k* through *B* into *C*, as described, and bottoming them with a tool like *I*, Fig. 4, or Fig. 7, I opened one side of the tube *B* and used it for a profiling tool to get the slot like *A*, Fig. 14, in the solid piece *C* and on both sides.

Using a tool like Fig. 8, shown more plainly in Fig. 10 and Fig. 11, and letting the smooth part *l* of Fig. 11 run in the sides of *A*, Fig. 14, while the file and

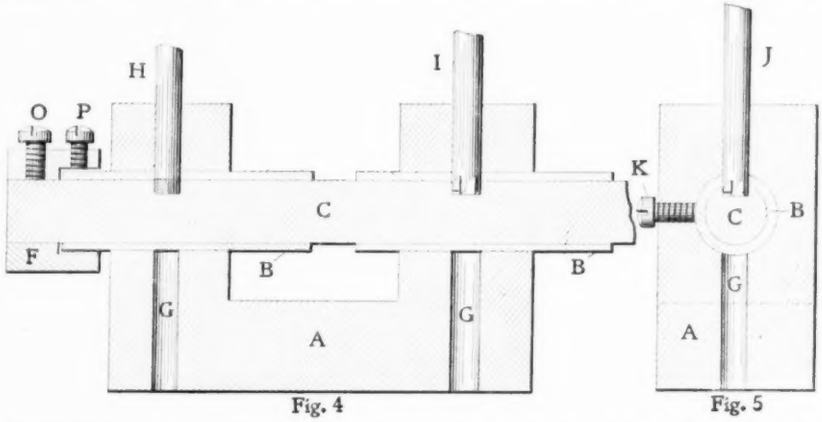

Fig. 4 Fig. 5

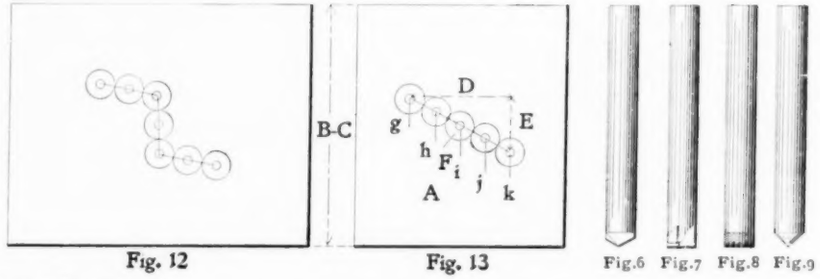

Fig. 12 Fig. 13 Fig.6 Fig.7 Fig.8 Fig.9

Fig. 10 Fig. 11 Fig. 14 American Machinist

FIXTURES AND TOOLS FOR GROOVING CAMS IN THE DRILL-PRESS.

Use side of *B*, now with holes in it, first with guide-pin at *H* to guide drill at *I*, then turn *C* half round in *B* and *B*, half round in *A*, with pin at *H* in slot. Then using the tube *B* seen in *F* for the profile, and a guide-pin at *H*, let the cutter *I*, running in *G*, do the work as the whole is moved forward and backward on the pin at *H*. If a tube like *B* is to be cut, the hole in *A*, Fig. 4, can be of size shown, but if the work is done on *C* make the hole to fit *C*.

To make other cuts on *C* loosen the set-screw *O* and turn *C* to any graduation on *F* desired, and fasten again. The set-screw *P* keeps *F* and *B* together. A fast-running upright drill makes a good profiler with this device, using collars on drill spindle for depthing-stops. Sinks with a butt-mill can be made in this way that would be impractical with the fixture shown in Fig. 2.

Fig. 10 shows how the file end should be cut under size to allow for increase in diameter caused by cutting the teeth. Cut file teeth before making butt-mill teeth.

Chicago, Ill.

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The widow and children of Hezekiah B. Smith, once a manufacturer of wood-working machinery in Smithville, N. J., and who died in 1887, have just been awarded by the courts the possession of his property, on the ground that at the time his will was made he was not of sound mind.

butt-mill combined in Fig. 11, cut the opening from hole to hole in *C*, a very nice sink can be routed out quickly. See also *H*, Fig. 4, for the position of Fig. 8 at work.

A collar *F*, Fig. 4, can be used where a number of operations at regular or irregular distances on *B* or *C* are wanted. Let *F* be graduated on the outer end and a line be drawn on the end of *C* to set the same by, or any special marks can be made on *F* for locating *C* by.

Annealing Steel.

In the last number of "Sparks From the Crescent Anvil," Mr. F. A. Pratt, of Hartford, contributes an article which no steel worker or tool-maker should fail to read. We reprint it below:

We have most of our tap steel annealed at the place where it is made. We have had it done in this way for some years, with the exception of our long stay-bolt taps, which we have found require more care in annealing than the steel-makers will give it.

More steel is injured, and sometimes spoiled, by overannealing than in any other way. Steel heated too hot in annealing will shrink badly when being hardened; besides, it takes the life out of it. It should never be heated above a low cherry-red, and it should be a lower heat than it is when being hardened. It should be heated slowly and given a uniform heat all over and through the piece.

This it is difficult to do in long bars and in an ordinary furnace. The best way to heat a piece of steel, either for annealing or hardening, is in red hot, pure lead. By this method it is done uniformly and one can see the color all the time. We do some heating for annealing in this way and simply cover up the piece in saw-dust, and let it cool there, and we get good results. All steel-makers know the injurious effects of over-heating steel and of over-annealing, but their customers are continually calling for softer steel and more thorough annealing. Until users are educated up to the idea of less annealing and to working harder steel, both will suffer, for the user will continually complain of poor steel.

Several years since we caught on to the fact that steel was injured by overannealing, and that good screw-threads could not be cut in steel that was too soft; our men would rather take the steel bar direct from the rolls without any annealing than to take the risk of annealing. At present we get it from the makers in passable condition, but not as it should be; and unless the steel-makers find some way to heat the bars of a uniform heat, and at a low cherry-red, we must either use it raw from the bar or anneal it ourselves. We find, also, that this soft annealing makes a much greater shrinkage and spoils the lead of the thread, and that from the bar without any annealing there is very little trouble in this respect.

When O. H. and Bessemer machine steel were first introduced they were poorly made and hard to work. Users constantly urged the makers to make it softer, until when a maker could say his steel was as soft as iron, and not more than .10 or .15 of 1 per cent. carbon, he had the market. This company found out early that this soft machine steel was almost worthless. A shaft would bend easily in working and if a lead-screw was to be cut it was not possible to get a smooth thread and a good finish.

Now we either make shafts and spindles of cast steel of a high carbon, or of machine steel of about .50 per cent. carbon, without annealing. Our men kicked at first, but now they complain if it is soft, because they cannot cut a good thread and cannot keep it as true.

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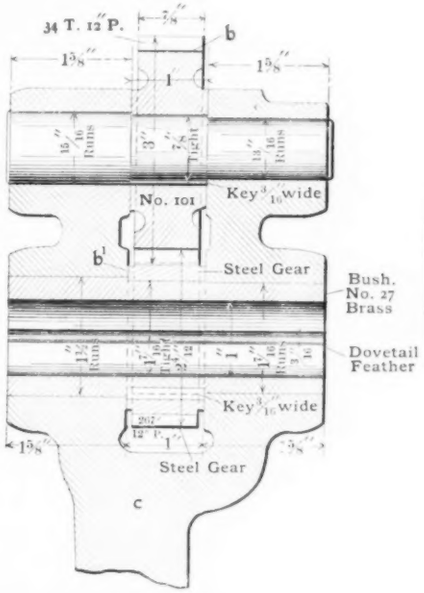
"The best of everything is still made in this country [England]; and those who want the best—and they are multitudinous—must come to us for the satisfaction of their wishes."—The Engineer.

A Universal Milling Machine.

We illustrate herewith a universal milling machine, designed and built by the Davis & Egan Machine Tool Company, Cincinnati, Ohio. It possesses a number of points of interest. It has longitudinal, angular, cross and vertical feeds in both directions, with automatic stops for all. The machine is made either without or with back gears, the former, here shown, being designated as No. 1 and the latter as No. 1½. The dimensions which we may give will refer to the back-geared machine.

The machine has fifteen different feeds, alike in each direction, the gearing for all being integral with the machine, and the changes being made by the shifting of a lever or the changing of a belt on the three-step cones. The main spindle is prolonged at the back of the machine, and has fastened upon it five gears (Fig. 1) of 24, 32, 40, 48 and 56 teeth respectively, the largest toward the front of the machine. An intermediate shaft *f* (Figs. 3 and 4) splined the entire length between its bearings has a sliding sleeve with a pinion b^1 on the center of it, with a hood or tumbler *c* enclosing it and sliding with it. The endwise movement of this pinion is such that it may be slid opposite either of the gears on the main spindle. The tumbler *c* carries an idler gear *b* constantly in mesh with b^1. When the tumbler is slid to bring b^1 opposite either gear on the main spindle it is also rolled toward the spindle to bring the idler gear *b* in mesh with that gear and thus give motion to shaft *f*. The tumbler carries a handle by which it may be shifted and a spring plunger which drops into holes on the brackets properly



SECTION OF TUMBLER.

Fig. 2

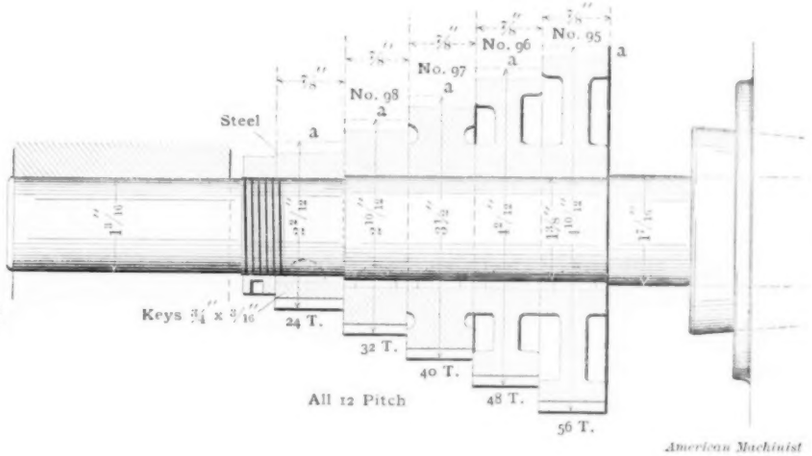


Fig. 1

THE FEED CHANGE GEARS.

located both longitudinally and angularly to bring the gears properly in mesh. This arrangement gives five positive speeds to shaft *f*, and, as will be seen, it is essentially the same arrangement as is used on the Hendey-Norton lathe. On the back end of the shaft *f* is fastened a gear which, with the familiar three-gear reversing device between, drives the feed cone shaft. A belt connects this cone with a second cone, supported by a bracket at the back of the main column, and a universal jointed, telescoped shaft leads from this to the front of the machine. As the cones have three steps, this gives a range of fifteen feeds in each direction, and an index plate near the handle of tumbler *c* gives the list of feeds, which range from .004 inch to .07 inch per revolution of the cutter.

The shaft from the driven cone to the front of the machine is on the right hand side as one stands in front and facing it, so that it is not visible in the view which we give, nor the gearing by which motion is transmitted to the several worm shafts which operate the horizontal screws and the shaft which connects the miter gears with the vertical screw. The arrangement by which the cross and vertical feeds are automatically thrown out is, however, seen on the side shown in Fig. 3. Lifting the handle *i* throws in the cross-feed, and it is held up by the square notch in the vertical arm of the right-angled lever *h*. The vertical plunger *j* is slotted at its lower end and fits loosely over the horizontal arm of lever *h*. The rod *o*, fixed to the saddle, carries the adjustable dog *k*, which may be set wherever required. As the saddle feeds in, this dog comes in contact with the beveled top of plunger *j*, forcing it down and drawing out the vertical arm of lever *h*, which allows the handle *i* to drop and stops the feed. But one dog *k* is shown, as it can be tipped up and slipped down to the other side of plunger *j* when desired to be used in the other direction. The operation of the stop for the vertical feed is quite similar to this, and it is not necessary to describe it.

The frame of this machine, including the uprights for the spindle and the overhanging arm is a single casting, the body of the column being used as a cupboard for cutters and tools. The spindle is of crucible steel, running in phosphor bronze boxes, which have take-up for wear. It has a 11-16 inch hole through it and the front takes No. 10 B. & S. taper. The driving cone has four steps for 3-inch belt. The back gears and all the gears on the machine are covered by shields. The overhanging arm is 3¾ inches, and it may be swung up out of the way or slipped out entirely. The table has a working surface of 34x5⅛ inches, with one T slot and an oil dish all around. The length of the table feed is 20 inches. The screw is provided with a patented device for taking up the wear. The spiral head and tailstock swing 10 inches diameter by 17½ inches long. The head may be set anywhere from vertical to 10° below the horizontal, and with an angle plate can be set at any angle on the table. A rotary pump gives the cutter a plentiful supply of lubricant, which is circulated continually.

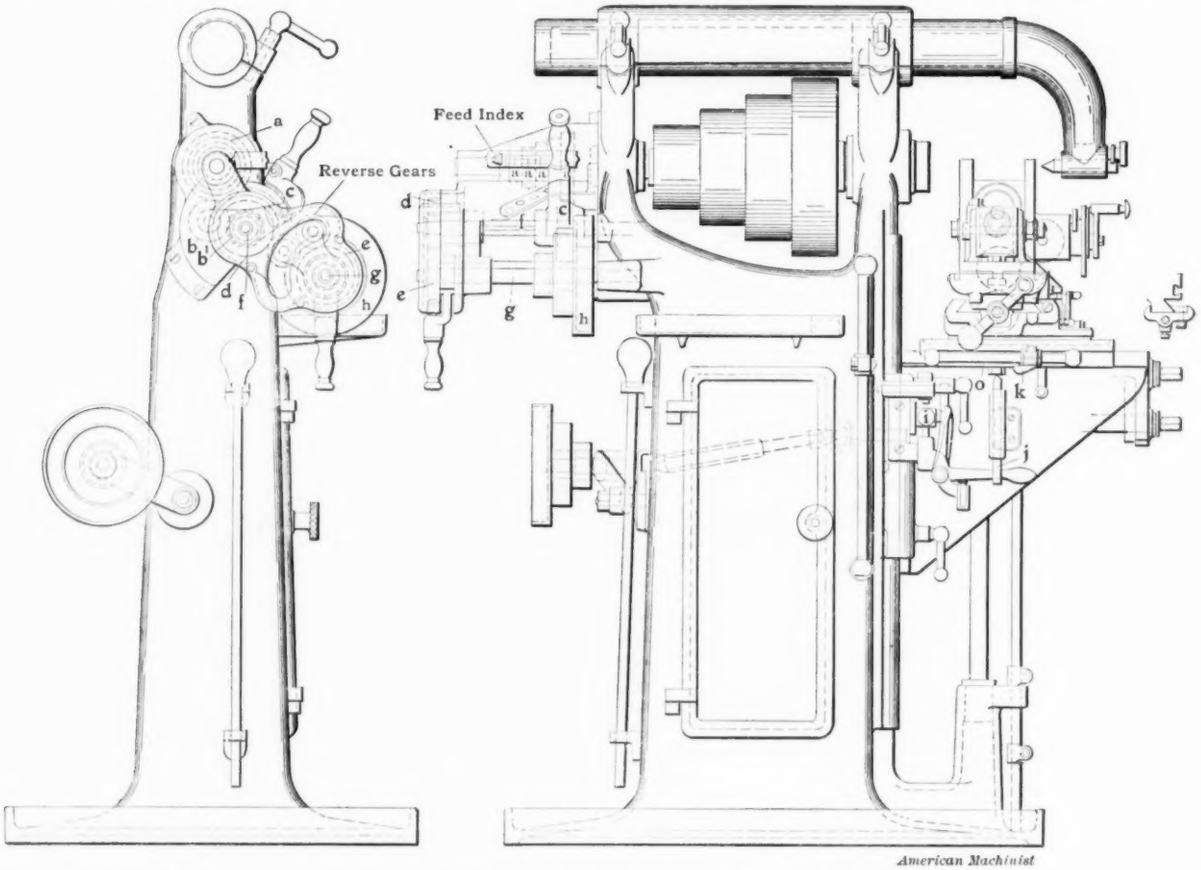


Fig. 4 A UNIVERSAL MILLING MACHINE. Fig. 3

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A Good Record.

In the last number of the "N. C. R." President John H. Patterson, of the National Cash Register Company, Dayton, Ohio, reviews the past year's work of the company and its employés, and expresses his complete satisfaction with it. Among other things he says:

"In 1897, 237 were added to the total number of employés at the factory; the wages of the employés were increased an average of $1.37 per week; we increased inventions, patents, machinery and floor space; two new experimental departments were established; new sales offices were opened in the United States and Europe, and the old ones were bettered; Russia, Italy and Austria were developed as cash register fields; our organizations were increased and improved in all countries;

our schools for training salesmen were bettered, both in this country and abroad; and nearly one hundred educated men were added to the selling force.

"During the year we reduced the selling price of our registers in the United States an average of $25 each; our sales agents all over the country were paid $650,000, and the workingmen of Dayton $900,000, both in currency equal to gold.

"We improved the appearance of the grounds surrounding the factory, and did more landscape gardening than ever before; we improved every department in the factory; we increased the prizes offered for the best suggestion by employés from $500 to $1,000 a year in gold, as a result of which about 4,300 suggestions were received, of which 1,078 were adopted.

"We have solved the labor problem by putting into practice, as far as we are able, the Golden Rule; and we have made it possible for others to adopt it, by proving that its adoption pays in dollars and cents, while the reflex influence upon the community at large is helpful in the highest degree.

"All this has been done through organization, enthusiasm and hard work, and through the introduction of modern machinery, which has enabled us to reduce the cost of manufacturing, while increasing the average wages of our employés.

"The success of the past year has not been my success, nor the success of the Executive and Factory Committees alone, but it has been the success of the company as a whole, and every man in its employ should feel proud that he has had a part in it."

It will be remembered that we published, on pages 225, 240, 249 and 279, last year, a full illustrated account of this remarkable establishment.

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Oil Tube Drill and Socket.

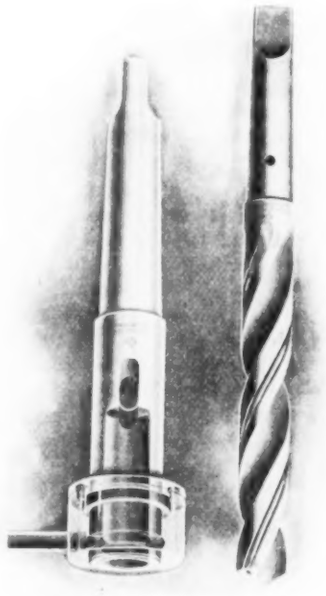
We have received from the Cleveland Twist Drill Company, of Cleveland, Ohio, a drill and socket from which the accompanying engravings have been made. With them comes a letter from Mr. J. D. Cox, Jr., manager of the above-named company and inventor of the device. In describing it we think we cannot do better than to quote from the letter referred to, which we do as follows:

"The use of oil tubes let into the 'Land' of a twist drill to feed oil to the cutting lips was known to the ancients, but very little use was made of this knowledge in a practical way till the advent of the modern bicycle, and the modern bicycle hub machine. In these machines the hubs are made from the solid stock and shaved into shape by two tools operating on opposite sides at the same time. At first the ordinary twist drill was used to bore the hubs out, and 35 hubs per 10 hours was considered a good day's work.

"The shaving tools could finish their part of the work in less than half the time required to drill the holes. This led to the adoption of the oil-feeding drill, and by its use the product of the machines was increased to 45 hubs in 10 hours, and in some instances as many as 50 in 10 hours have been turned out.

"The drill was still away behind the capacity of the machine, because the stock could not be revolved fast enough to get the maximum results from the drill without being too fast for the shaving tools.

"The next step was to discard the turret head, which held the drill, and substitute for it a sliding head with a drill spindle in it, geared up from the main driving head to revolve twice to one revolution of the stock. This arrangement greatly increased the rate of the drilling so that now the drill beats the shaving tools and the number of hubs turned out has increased to over 100 in 10 hours.



OIL TUBE DRILL AND SOCKET.

"This company, believing that there were many shops that would like to increase the capacity of their drilling machines—especially where they were drilling forgings or machinery steel—started to work to see what could be done in this direction, and after several more or less satisfactory experiments produced the oil feeding socket and the form of oil tube drill shown in the accompanying illustrations. Everyone at all familiar with the drilling of wrought iron or machinery steel knows how hot the drill gets, and how nearly impossible it is to get even an insufficient supply of oil down to the cutting lips, because the hot chips coming up burn it all away or absorb it long before it gets to the spot where it is most needed.

"The socket illustrated is surrounded by a collar in which it revolves. From the collar projects a tube, to which is attached the feed pipe heading from a force pump or a bucket suspended from the ceiling overhead. The tube opens directly into a chamber cut clear around on the inside of the collar. This chamber communicates by two orifices with a second chamber running entirely around on the inside of the taper hole in the body of the socket. The oil tubes in the drill are carried up the shank of the drill and have their inlets in such a place on the shank as will insure the end of the tube coming directly in line with the channel on the inside of the socket. When the shank of the drill is inserted in the socket there is a continuous communication through its tubes, the channels and orifices in the socket to the supply pipe on the collar, and two good streams of oil or other lubricant can be forced under any pressure desired to the cutting lips, no matter how deep the hole which is being drilled. Where this oil-feed socket and oil-feed drill are used the drill can be run at a higher rate of speed and fed much faster without heating or becoming dull.

"We recently drove a 1 1-16 inch drill through 55 feet of machinery steel in 12 hours without grinding the drill during the operation. If any of your readers will undertake to do the same amount of work in the same time with the ordinary twist drill they will see where this simple little device comes in."

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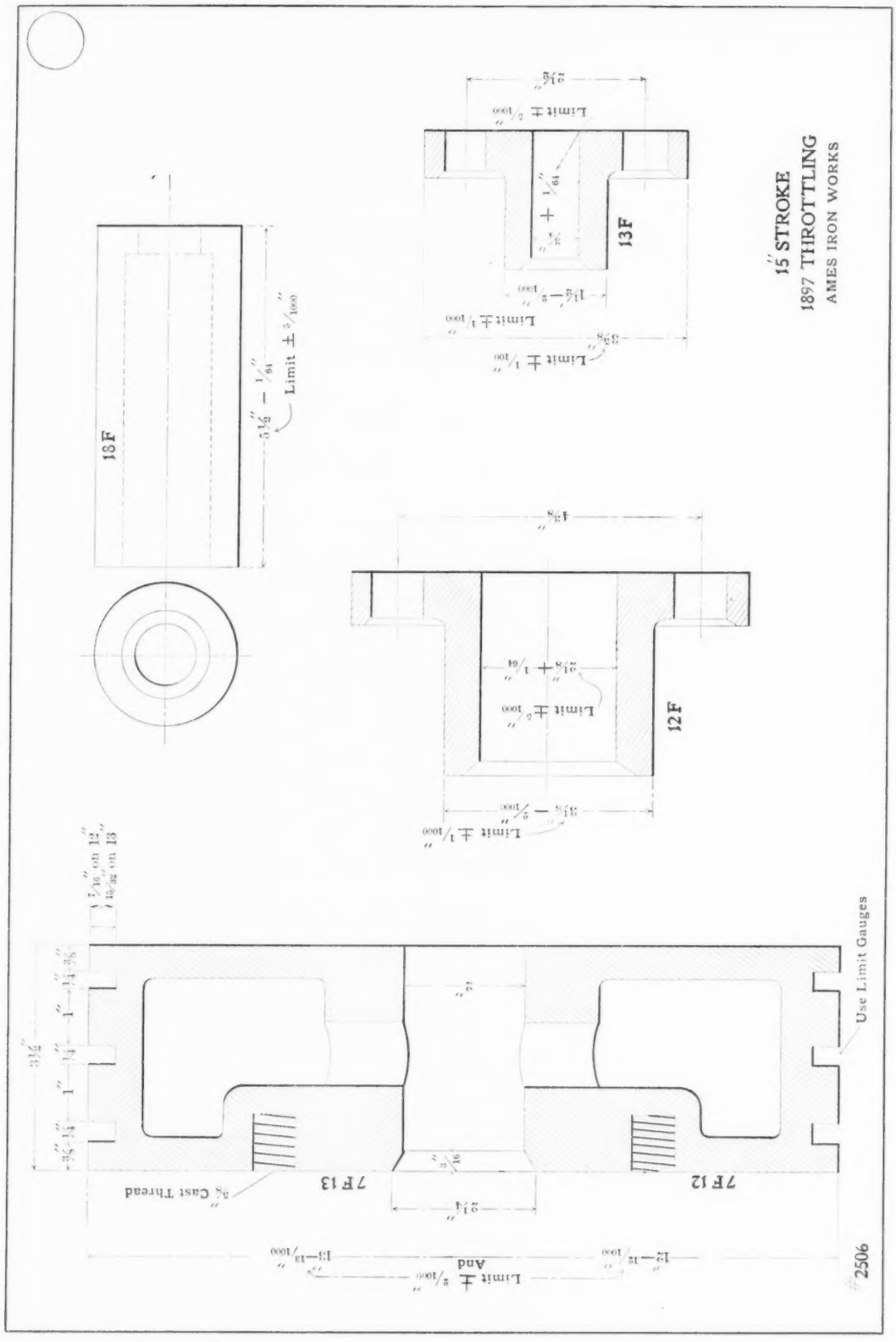
Drawing Office Practice at the Ames Iron Works.

The practice of these works as regards drawings is peculiar in more ways than one. No one who has worked at the lathe or bench need be told of the convenience of small drawings nor of how often the superior wisdom and authority of the drawing office imposes large, awkward sheets as a supposed necessity. Mr. Armstrong carries the use of small sheets further than we have before seen it done. His standard size of shop prints is 6x9 inches, and all details of the department of which he has charge are shown on sheets of that size. Special work sometimes requires larger sheets, though not often. For example, an engine to be used with a direct connected dynamo usually requires a special base and pillow blocks, which would be shown on a larger sheet; but all standard work in the engine department has been reduced to the small size named.

The original drawings and tracings are made on large sheets, which, however, are ruled into 6x9 inch spaces, and beyond these lines no view of any piece is allowed to go. In the case of a large piece of which several views are neces-



SAMPLE AMES IRON WORKS DRAWING—FULL SIZE.

sary, as, for instance, a frame or cylinder, the different views are placed in spaces by themselves, which, however, are cut apart for the shop as though they were entirely independent of one another. The mounting of the prints for shop use is still more unusual. For this purpose Mr. Armstrong has bound stub books made—these books, before filling with prints, being much like a check book after the checks have been removed. The prints are pasted in these books, leaving occasional blank stubs for use in case of changes, and with the different views of the same part pasted to consecutive stubs to keep them together. Three books of each set of prints are made—one for the drawing office, one for the shop and one for Mr. Armstrong's personal use. In case of changes, the old print is cancelled, but not destroyed, and has entered upon its back a memorandum of the number of the last engine made from it, and on one of the blank stubs

a new print of the revised tracing is pasted. This goes on until the end of the year, when the books are gathered up, an entry of the year to which they belong is made on the back, and one of them is filed away in a fireproof safe as a record of that year's work—an entirely new book of current drawings only being made for the next year. The usual order will thus be seen to be reversed—the prints being the record drawings and the tracings being regarded as mere tools for making the prints. Each book of prints includes a page giving a complete list of the pattern numbers for that engine, and also a print giving a list of all bolts, studs and other fittings necessary for one engine. The pattern numbers also appear against the drawing of each cast part. The system of pattern numbering gives a letter to each engine, which is preceded by a number for the part, the number being the same for the corresponding part of all sizes of engines.

In a new line of plain slide valve throttling engines upon which the Ames Iron Works are now engaged, Mr. Armstrong is applying defined limits to all dimensions. The use of limits in such large work is unusual, and in connection with this system another innovation is made in entering these limits on the drawings. In connection with work which is produced in sufficiently large quantities to justify a complete set of limit gages, this system would not be advisable; but in work of the character of engines many dimensions must be made to measure, and the entering of the limits on the drawings is a continuous record for the guidance of the workman. For dimensions of this kind liberal use is made of Professor Sweet's measuring machine. Mr. Armstrong considers it to be really absurd to give an exact dimension in such cases. No one expects a 6-inch shaft, for example, to be exactly 6 inches in diameter. Even standard gages are only brought within defined limits of exact size. In ordinary work the amount of variation is either made so small as not to be noticeable with the methods or instruments used, or it is left to the judgment of the workman or of the inspector, with the result that some parts are not made close enough; but more, probably, are made closer than there is any real need of. Mr. Armstrong considers that the competent designer should be better able to define the limits than the workman or the inspector, and that by his doing so uniform results can be secured, as well as accuracy, where necessary, while unnecessary labor can be saved where minute accuracy is not required.

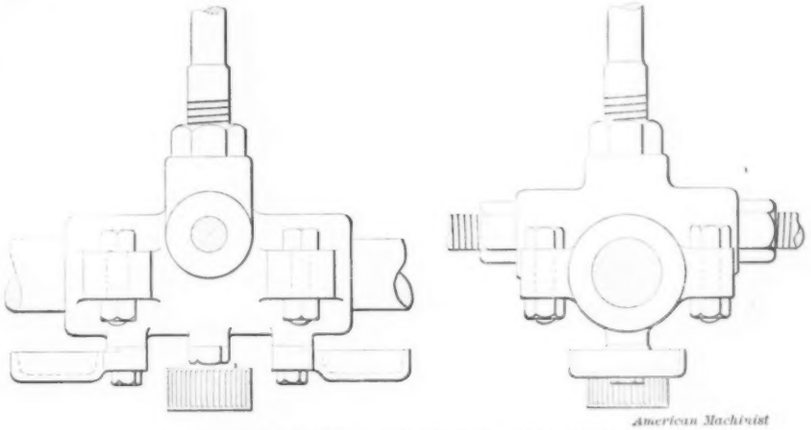
We reproduce herewith one of these drawings, full size, as used in the shop, from which the method of entering the limits will be seen. Some of the dimensions will be seen to have no limits given, but this is always for a special reason. Thus the thickness of the piston is a pattern dimension of which the only use on this drawing is to insure that the casting is right. The piston ring grooves, on the other hand, are turned to limit gages which themselves define the limits. Again dimensions which are determined by jigs or other fixtures do not have their limits placed on the drawings. Examples of this will be seen in the given distance between the bolt holes of the stuffing box glands.

▲ ▲ ▲

A New System of Hanging Shafting.

The cuts shown herewith, which we reproduce from the "Engineer," London, are deserving of more than a passing glance. They represent not merely another way to make a shafting hanger, but a novel and apparently, for many situations, an excellent system for the suspension of shafting. It is adopted in the shops of Messrs. Humpage, Jacques, and Pedersen, makers of machine tools, micrometer gages, gear cutters, etc., Bristol, England. In each bay of the shop, the roof of which is one tooth of an extensive "saw-tooth" construction, there are six lines of shafting suspended by the style of hangers here shown. Two shafts 2 inches in diameter near the center, run at 100 revolutions for heavy tools, two 1¾ inches in diameter at the sides, at 125 revolutions for medium tools, and two 1½ inches in diameter for the balconies, run at 150 revolutions for light tools. Each of the four larger shafts is driven by a separate main belt. The vertical roof ties are extended beyond the main horizontal tie rod a few inches, and screwed right hand. A right and left union nut with jam nuts couples the vertical rods which carry the bearing to the vertical rod ties, and also provides for the vertical adjustment of the bearing. Rods from each side provide for the lateral adjustment of the line, and give it the necessary resistance to belt pulls and other strains. As the bodies of the rods are only about one-half the diameter of the shafts, and as there is absolutely no other attachment to the boxes, the lightness of the arrangement is self-evident.

The bearings are of cast iron, four diameters in length, made in halves and doweled, with four belts and nuts to hold them together. Lubrication is provided by a Stauffer lubricator fitted to the middle of the bottom of the bearing, and small drip cups are attached to the ends to catch the spent grease. Any length of shafting, when uncoupled, may be taken down by removing the lower halves of the boxes without disturbing the alignment. The side bosses are tapped one right hand and the other left, the outer ends of the horizontal tie bars passing through columns supporting the balconies and being secured by lock nuts. One end of each shaft is in a wall box, with collars to take the end thrust.



A SUSPENSION HANGER FOR SHAFTING.

▲ ▲ ▲

Some Points on Foreign Trade in Machinery.

Every American engineer or machinery man who goes abroad to study the business situation not only adds to his own personal stock of knowledge but usually also to the general stock as well.

Mr. A. Brotherhood, of New York, who has been for several months past traveling all over Europe in the interest of his firm, Manning, Maxwell & Moore, is not only an engineer, but in his work has enjoyed the advantage which comes from the fact that he originally came from England, has many acquaintances there, and at the same time has lived here a long time, thus becoming familiar with our own practice, mechanical and commercial.

Discussing the situation soon after his recent return home, he expressed his conviction that our business abroad would surely increase, especially in Great Britain. Proprietors of machine shops there are awakening to the fact that they are being distanced by our generally superior equipment and superior methods, and after the present struggle is over

will begin to re-equip. They will buy largely in America, and the degree of our success in handling the business will depend somewhat upon our methods; especially upon whether these methods shall be determined by careful study and careful consideration of facts or by prejudice and preconceived notions of what facts ought to be.

He deprecates the talk of "pauper labor," and calls attention to the fact that perhaps the nearest approach to pauper labor that can be found in Europe is in Russia, and this is the very country from which we have least to fear in the way of competition.

In Continental countries especially the matter of credits seems liable to give us some trouble. When a shop proprietor, who may be considering the purchase of a tool, is informed that he must pay for the American tool on its arrival in New York—months before he can possibly have it in operation in his shop—while at the same time the German representative offers from six months' to a year's credit, the American is obviously seriously handicapped. Better banking facilities would help this difficulty and would also do away with the advantage enjoyed by England from the fact that at present practically all exchange must go through London. While in Russia some large remittances were to be made to an American house in payment for traveling cranes sold by Mr. Brotherhood. It was found that the remittances could not be made direct to New York without an attendant expense which made it practically necessary to do the business through London banks.

▲ ▲ ▲

A Patent Experiment.

BY FRANK RICHARDS.

As some special attention has of late been drawn to the ways of a certain class of patent agents, and as many readers of the "American Machinist" are interested in one way or another in patents, present or prospective, it occurred to me that I could be of some service to somebody if I could do something to show the "present state of the art" of the patent agent. I accordingly selected two or three firms which seemed to stick out most prominently as the subjects of a simple experiment, with the results which I proceed to narrate.

The story properly has a prologue, which is as follows: A United States patent was granted February 13, 1866, to Frank H. Richards (your humble servant, then of Lansingburgh, N. Y.) for an Improvement in Balanced Slide Valves. Fig. 1, here shown, is a fac-simile reproduction, without the letters of reference, of the principal drawing accompanying the specification of that patent. It is not necessary to give here any description of the valve or of its operation, as that will appear later. So much for the prologue.

About the middle of September of last year I prepared the sketch Fig. 2, and made from it several tracings. I also made some copies of the following description of the valve:

DESCRIPTION OF BALANCED VALVE.

The valve seat is the same as is commonly used, only the steam in this case comes in where the exhaust generally goes out, and the exhaust goes into the chest and out of a pipe from there. The pressure is therefore under the valve instead of on top of it. The cover of the chest has a valve face just like the main valve face, only the ports are shallow and connected with the opposite ports

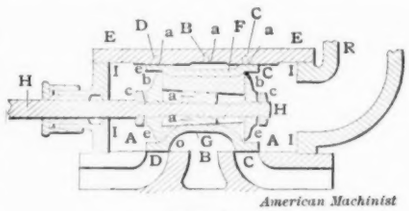


Fig. 1

THIRTY YEARS OLD.

in the main valve face by little tubes outside running from one to the other, or by holes drilled down through the side of the chest. As the two valve seats are alike, and as the pressure in the opposite ports is always the same, the valves must balance each other, if they can only be held to their seats. This is done by the wedge on the valve rod between the valves. The flanges on the valve rod are tapped and the nuts are jam nuts. The flanges are set up close to the shoulders on each end of the valves, but not tight, and then they must be left so that the valve rod can be turned around. The valve rod has a coupling on it, outside the chest and seat shown, which may be slackened when it is necessary to turn the rod. As the wedge between the valves is screwed on the rod, it is moved along one way or the other when the rod is turned, and in this way it can be easily adjusted so that the valves will be held nicely to their seats. This description applies in every particular as closely to Fig. 1 as to Fig. 2.

At this time the proceedings for the disbarment of John Wedderburn & Co. were in progress and they might have been presumed to be then cautious and alert. A copy of the "National Recorder" came into my possession, and I cut from it a coupon of which the accompanying is a copy:

I filled out the coupon and sent it with the following leter:

Dear Sirs:

I inclose coupon from "National Recorder" with $1 for a year's subscription. I also inclose a little tracing and description, on another sheet, of a balance valve for a search of the Patent Office files to determine patentability and also for entrance in the Wedderburn Competition. Please report as soon as possible. I have shown the invention to two friends, so that I have evidence to protect me if anyone should try to steal it. Yours truly,

FRANK RICHARDS.

In a few days I received the following communication:

Mr. Frank Richards, New York, N. Y.:

Dear Sir:

We are in receipt of your favor of recent date, inclosing the sum of $1 and coupon from the "National Recorder" entitling you to a search of the records of the Patent Office of your improvement in valves.

In reply thereto we would state that your name has been placed on the "Recorder's" subscription list, and the paper will be sent regularly to your address.

We will report that we have made a thorough search of the records of the Patent Office in your behalf, and herewith inclose as a result of such search copies of patents Nos. 114,344 and 155,298, to show you the state of the art and for your general information. As we understand your invention, we will state that we believe you have a patentable invention in view of these references, but before preparing the application papers we would prefer that you send us another drawing, or a model, of your device fully setting out all the features thereof, especially dwelling upon the screws at the end of the valve for adjusting the same and also the screw at the piston head, so that we can thoroughly understand the same before preparing the application papers.

Upon receipt of this information and the sum of $20, covering the first Government fee and the cost of one sheet of official drawings, we will prepare the ap-

This coupon, accompanied by $1.00, entitles the sender to a year's subscription to the NATIONAL RECORDER, and

A FULL SEARCH

of the Patent Office files to determine whether the invention named herein and described in the accompanying letter is probably patentable. It also enters the invention in the Wedderburn Competition.

Invention_____

Name_____

Address_____

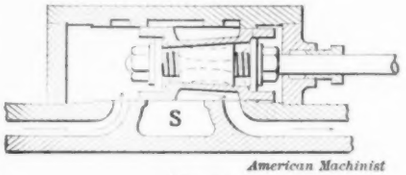


Fig. 2

PATENTABLE, SO THEY SAY.

plication papers and send them to you for approval and execution.

Very truly yours,

JOHN WEDDERBURN & Co.

(2 inclosures.)

Washington, D. C., Sept. 22, 1897.

The two patents inclosed had nothing to do with the case, any more than had

FOR A DOG COLLAR.

the remarks in the body of the letter. Two days later I received the following:

Dear Sir:

We take pleasure in notifying you that a sterling silver medal has been awarded you. This is in accordance with our purpose to give each inventor who displays ingenuity in devising a good invention a "Reward of Genius" by way of recognition of his inventive talent. Receiving a medal does not in any way jeopardize an inventor's chance for securing the large prize of $150, should he proceed to secure protection for an invention, if passed upon favorably by the Board of Awards. We inclose you a United States Treasury certificate with the medal, which is sent you under separate cover from the Director of the Mint certifying to the fact that the same is pure silver. Should you need capital to further develop your ideas, or desire to sell them to capitalists, this medal would doubtless be of special value to you in securing their attention and consideration.

Fortunes have been made from valuable inventions, and we sincerely trust that you may be equally successful in the same line.

Assuring you of our hearty co-operation and willingness to serve you at all times, we remain,

Very truly yours,

JOHN WEDDERBURN & Co.

Washington, D. C., Sept. 24, 1897.

Fig. 3 shows the medal referred to. This is the medal which the Commissioner of Patents said "could be worn by a man or a dog with equal propriety." I have not yet worn it. A day or two later the medal was followed by a printed undated letter or circular signed by the "National Recorder" Publishing Company and offering to publish my likeness with sketch of my life, "in order that inventors and those who are striving to become such may enjoy the advantage of the experience of their successful colleagues"—all for $7. I still have the $7. Other parties have been offered the same glory for $5.

I received the "National Recorder" regularly until it was stopped by the Post Office authorities.

Another firm of patent solicitors doing a large business and having clients all over the continent and elsewhere is that of C. A. Snow & Co., Washington, D. C. I have a letter from them in which they say: "We beg to say that a careful estimate, though not an exact count, will put the number (of clients) at not less than 15,000. For nearly all of these we have procured patents, but for some only copyrights, trade marks, caveats, etc." I believe their statement is reasonably correct.

This firm issues various printed matter for circulation. Their pamphlet, usually sent to all with whom they come in communication, says: "Upon receipt of model, sketch or photograph, we will make a careful free preliminary examination in the Patent Office, in order to see if the invention is probably patentable. If we decide it cannot be patented, we will write you with explanation, but if we are of opinion that your invention is patentable, *and you have previously sent money*, we will, etc."

Acting upon this offer of "a careful free preliminary examination," I sent to C. A. Snow & Co. the sketch and description of the balance valve, as above. I received first an acknowledgment of receipt, and a few days later the following letter:

F. H. Richards, Esq.:

Dear Sir: In reply to yours of recent date, we have made a careful examination and search in the matter of your slide valve, and have the pleasure to write that we consider it patentable.

* * * * * * *

Upon receipt of $20, the first payment, which includes the amount required for one sheet of official drawings, to be filed in the United States Patent Office, and the first Government fee, we will prepare your petition, specification, claims, and drawings in due form, and send the papers to you, with instructions how to execute them: and we will also inclose a print of the drawings. When you shall have returned the papers properly signed, and accompanied by a certificate of deposit or other security, to insure the prompt payment of the attorney's fee due on allowance of patent, your application will be regularly filed and prosecuted to a final issue.

Yours truly,

C. A. SNOW & Co.

Washington, D. C., Oct. 2, 1897.

I sent the sketch and description to another firm located in Washington and received a postal acknowledging the receipt of it and promising a thorough examination and an early report. Then I began to receive from this firm large quantities of printed matter relating to patent business. I also received various souvenirs, a lead pencil, two calendars, a dozen toothpicks, a 6-inch rule, a 1-foot rule or ruler, a pocketbook, the value of the whole amounting to about seven and a half cents on a careful estimate. I have also a card which entitles me upon its return, with my name and the number and date of a patent issued to me, to a valuable album, "duplicates $2.50 each." But I have not been able, although I have written to them again, to get from them any report as to the novelty or patentability of my balanced valve. These are the only offers of free examination that I have yet tried.

▲ ▲ ▲

Explosions of Air Compressors.*

The accounts of frequent explosions of air compressors induced the L. A. Riedinger Machine Company, of Augsburg, Germany, to investigate the subject. They installed a belt-driven compressor 7 inches in diameter by 14 inches stroke, running 132 revolutions per minute, cooled externally only, to be used for observing during a long period the compression of air to increasing pressures, in order to be able to perfect single-acting compressors as nearly as possible, and to determine the pressures to which it is safe to use them.

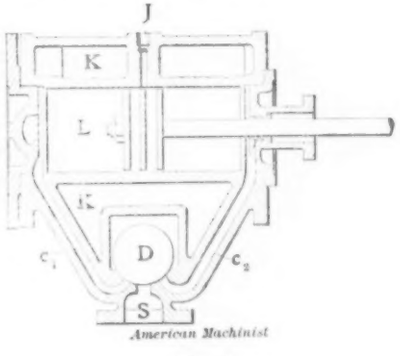


Fig. 1

EXPERIMENTAL COMPRESSING CYLINDER.

The compressor was provided with the Strnad cylindrical valve, which carries the automatic valves on its back. Fig 1 shows the general plan of the compressor, while Figs. 2, 3 and 4 show the valve de-

*Translated and condensed from "Gluckauf" for the "American Machinist" by Gus C. Henning, M. E.

tail. Pressure chambers d_1 and d_2 are closed by poppet valves R_1 and R_2, while A_1 and A_2 are spaces to receive pressure which balances the valve. K is the chamber in which water circulates to cool the external surface of cylinder, valve chest and air ducts c_1 and c_2. Figs. 5 and 6 show the compressor plant in elevation

Fig. 3

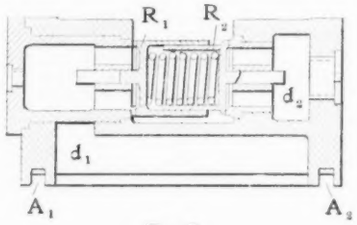


Fig. 2

Fig. 4

VALVES OF AIR COMPRESSOR.

and plan, F being the receiver, G the main air supply to the shops under a pressure of 7 to 8 atmospheres and H a release valve regulator, by means of which any desired pressure can be carried in F and read by a gage. The tests extended over several months, compressing the air to various densities up to that carried in the shop mains. Lubricants were introduced at J, Fig. 1, and passed through the cylinder and ducts c_1 and c_2 to valve chamber D. The greatest variety of lubricants was used, including valvoline, which is especially recommended for hot-air engines. Using best valvoline oil with a small addition of petroleum worked well and continuously

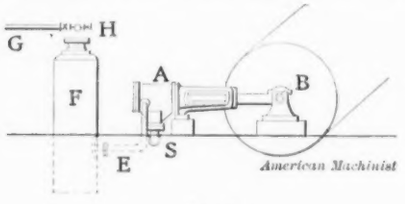


Fig. 5

up to pressures of 75 pounds. As soon as pressures of 105 to 120 pounds were reached, however, it was noticed that the sound of suction at S became weaker and weaker until finally it ceased altogether. The valves continued to work, but no more air was drawn in, and on opening the compressor it was found that C_1 and C_2 were completely choked with decomposed lubricant, so hard that some of it had to be removed with hammer and chisel. Ordinary machine oil choked these passages in five days, while in the case of the best oils it took twelve days to close them. Thus the intermittent compression of air becomes a very sensitive oil test. The great number of revolutions cannot be the cause of this action, as piston speed is the controlling element, which in this case was 5 feet per second.

Double acting compressors with valves at each end, as shown in Fig. 7, have been running at this speed continuously for years without giving this trouble. Therefore, the conclusion is permissible that the long curved ducts C_1 and C_2 are the cause. Two explanations are possible. As heat is given off during compression, a partial evaporization of the oils takes place, and the fatty oils are then partially deposited on the cooled surfaces of C_1 and C_2. On the other hand, the lubricant flowing down the cooled surface of the cylinder may be carbonized on the hot part of the ducts C_1 and C_2, those not cooled by the circulating water, thereby, assisting to clog them. Probably both actions are supplementary to each other. This steady diminution of the ducts must cause rapid rise of temperature of the air, which is forced through in spite of it, and with increasing friction in proportion to the choking.

The following table gives the temperatures of air compressed by the intermittent, externally cooled compressor:

Pressure Atmospheres.	Temp. °F.
2	185
3	248
4	302
5	346
6	382
7	418
8	448
9	480
10	512
11	527
16	630
21	712

This shows that a pressure of 10 atmospheres will certainly ignite the lubricant and that ignition is possible at much lower pressures in the presence of compressed air. Even in continuous compressors explosions sometimes occur of materials which become explosive under certain conditions.

Diesel says (in "Zeitsch r. d. Ver. D.," Aug., 1897, p. 787) that it is surprising how very low temperatures suffice to ignite combustible materials under compression.

That explosions occur even in continuous compressors which work under 6-7 atmospheres is proved by the following case: In the central power station of the Compressed Air Installation in Offenbach it happened twice, on the 16th March and 10th September, 1895, that a T connection between compressor and receiver exploded violently, showing a temperature of 248° F., emitting a strong smell of gas, there being no assignable cause. The fractures of metal showed perfect material.

In the case of the test installation previously described it is possible that continually recurring ignitions took place, and combustion only could explain the presence of the hard carbon found after such a short period of operation. A gradual transfer of the explosive substances from the compressor to the receiver may cause violent explosion of the latter, when a sufficient quantity has been collected in it. A proper arrangement of inlet and outlet pipes may correct this possible danger. If they are connected to opposite ends of the receiver no accumulation can occur; but if the air enters and exits from the same head the heavier explosive gases may descend gradually, causing an accumulation, while the air proper is constantly passing over it and out. The cold air in the bottom of the receiver absorbs the explosive fatty vapors from the hot air coming from the compressor. This was actually the case in the installation at Dortmund in a coal mine, and caused a most destructive explosion.

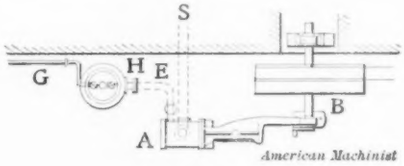


Fig. 6

AIR COMPRESSOR AND RECEIVER.

The essential points to be provided in all compressed plants are:

(1.) Prevention of "dead ends," where air can collect without circulation.

(2.) Use of coolers between compressor and receiver, where compression is

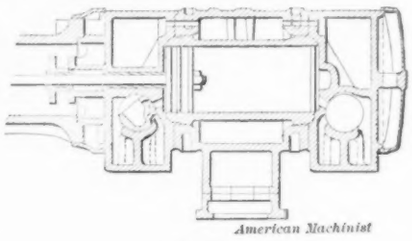


Fig. 7

greater than 3-4 atm. above atmospheric pressure, when using continuous compressors.

(3.) Use of independent valves and short ducts at opposite ends of cylinder of intermittent compressors.

(4.) Frequent cleaning of all passages when using a single acting compressor. The frequency of cleaning depending upon the pressure, piston speed, type of compressor and quality of lubricant.

(5.) The surface cooling should be ample, but care should be taken to cool

the valve chest and valves in a proper manner. If it is desired to take occasional samples of compressed air from the plant for purposes of analysis, the use of valves at opposite ends of cylinder in recommended, while pet cocks, which can be easily opened, should be avoided, because engineers are too prone to apply lighted matches for the purpose of determining the explosibility of the mixture.

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Letters from Practical Men.

Cooling by Re-expanded Air.

Editor American Machinist:

I cannot fully agree with your editorial comments appended to Mr. Hugo Bilgram's letter published in your issue for January 13.

There is no doubt at all that air expanded by blowing through a restricted opening does not, under ordinary circumstances, lose much temperature. I once knew of some experiments which were made to convince a skeptic on this point—in fact, they were made by the skeptic himself, and he owned up after they were made that he was convinced. The experiment consisted of inserting thermometers in air pipes, above and below the throttle valve of common direct-acting steam pumps, and, although the pressure was reduced by the valve from 60 or 65 pounds to as low as 18 and 20 pounds, the greatest fall of temperature observed was 2 degrees Fahrenheit, although, also, at the same time, the air cylinders of the pumps were covered with hoar frost. I should add also that the thermometers were first-class instruments, bought for the purpose, and provided with mercury wells to protect the bulbs from pressure. In the case of air passing through a throttle valve, the energy is expended in two ways; first, in accelerating the velocity of the air, and, secondly, in overcoming the frictional resistance of the passages. The velocity acquired in passing the opening is, however, mostly destroyed again as soon as the air reaches the full bore, leaving, as the final increase of velocity only that due to the increased volume of the air at the lower pressure. This remnant represents work done, and to that extent the air will cool. The destruction of part of the energy of motion through the orifice immediately restores the heat lost in producing the velocity, while the energy expended in overcoming the frictional resistances is restored again as heat in the very act of its expenditure; so that from neither of these two causes can there be any loss of temperature, and since, ordinarily, these actions far exceed the remaining increase of velocity due to the changed pressure, it follows that the loss of temperature must be slight.

The use of air in the cylinder of a pump or rock drill without expansion, is a different case. In this the valve is jerked open, and a much larger proportion of the energy of expansion is represented by the increased velocity of the exhaust and the disturbance of the surrounding air. Again, and of greater importance, we have, when the exhaust is opened, a cylinderful of isolated air which, by its expansion, pushes the exhaust before it, and so far as the air in the cylinder is concerned the action is precisely the same as though a cut-off were used. With a cut-off the expanding air pushes a piston in front of it; without cut-off it pushes the air out of the exhaust pipe and overcomes the resistance of the passages; that is, it does work *at a distance* and not on itself. The case will be seen to be entirely distinct from that of a throttle valve in a pipe, in which the pressure behind the valve is maintained by the compresser, and the only expansion is that of the air in passing the valve. In the engine this action takes place in the passages; but added to it is the expansion of the isolated air in the cylinder.

This is the rationale of the two cases as I understand it, although I am free to own that I have seen things in this connection which I could not understand. Some engines will coat their exhaust pipes with hoar frost, leaving the cylinder cold, of course, but still free from frost, while in others the cylinder will accumulate frost until it is buried out of sight—and this when, so far as I can see, the essential conditions are identical. I have never known an engine to coat its cylinder and leave its exhaust pipe free.

C. K. Jackson.

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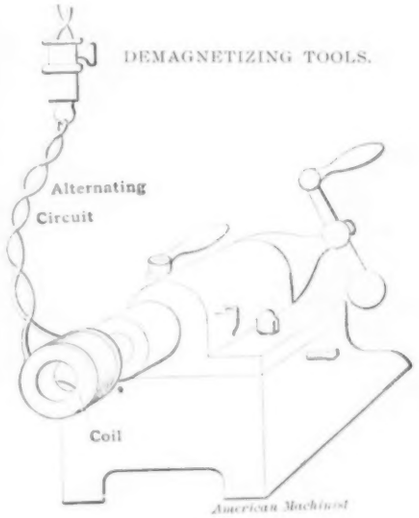
Demagnetizing Tools.

Editor American Machinist:

Some time since I was reading about one of your correspondents having trouble with magnetized tools. Formerly I was frequently annoyed with this disagreeable thing also, which I discovered was caused mainly by the various magnetizing influences always exerting themselves about an electrical shop. The first complaints were about a lathe, in which we wound fields, and during the process electric currents were sent through them to test insulation, the after effect being that chips of iron and steel would persistently hang in festoons about the centers, getting in the center holes and making trouble generally. Eventually it went from bad to worse, until calipers, lathe tools, scales and squares and so on got stuck on each other and they in turn on all the loose bits of metal in their vicinity, until it was declared a rank nuisance. At that time I knew less about it than I do now. In regard to the lathe, I supposed it was wholly magnetized, but, coming to closer investigation, I found the trouble existing entirely on the tempered centers. After deliberation we made what we call a shop coil, which is shown by accompanying engraving, and consists of a hollow spool wound with sufficient resistance—and terminates in an attachment—for lamp socket, on alternating circuit. Placing this little device over any magnetized piece the trouble will instantly disappear. To anyone troubled with this disagreeable freak,



DEMAGNETIZING TOOLS.

the coil will be a source of great relief. Our coil is now made part of the tool room equipment, and no complaints are heard from what at one time was an awful nuisance.

L. C. Sharp.

Omaha, Neb.

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That Leaky Valve.—Cast Iron Chips.

Editor American Machinist:

A dozen of your correspondents may have better reasons than mine for the leaking of Mr. Davenport's valve ("American Machinist," January 13), nevertheless I will give mine for what they are worth: Water under the same pressure will (for reasons that appear to me obvious, at least under conditions of steam and water together, as they are in the use of steam for common purposes), leak, or find its way between joints when steam will not. My assumption is that the pipe to the mill boiler is longer, and probably for part of its length exposed to a lower temperature—either or both—than the pipe from his own boiler, and hence more steam is condensed in it. Or the mill boiler may furnish wet steam and his own dry, or even superheated steam. Whatever may be the cause, or combination of causes, I assume that there is more water with the steam when it reaches the intersection of the drip pipe at the cross, when the steam is taken from the mill boiler, than when it is taken from his own boiler. This being

the case, the drip pipe is kept partially filled with water and there is a good deal of leak. When the steam comes from his own boiler dry or somewhat superheated, there is but little water to leak, possibly no more than that due to condensation in the drip pipe. When the leak is large considerable steam will appear, because, as the pressure is suddenly reduced, there is an excess of temperature and some of the water flashes into steam. When the leak is small, the small quantity of water is so gradually—we might as well say suddenly, perhaps—cooled by the atmosphere that no steam appears. Even if there is a slight steam leak in both instances, in the instance of the dry steam it is so suddenly condensed as to be unnoticeable, while in the instance of the wet steam it simply adds slightly to the volume of re-evaporated water from the leak.

Still another reason, though not so probable, is that the large quantity of water present with the steam taken from the mill boiler is, in a degree, stagnated in the drip pipe, and hence cooled, which brings about abnormal contraction in the valve and casing and causes a leak of steam. In other words, it is quite within the range of possibilities that at one temperature the valve will be tight against steam and leak at another temperature. As intimated, this is not given as the probable reason for the behavior observed by Mr. Davenport. It is a possible cause for such behavior.

The chip, illustrated, cut from a cast iron roll, is evidence of good material in the roll and good workmanship in the turning. In 1860 or 1861 the Putnam Machine Company were making some steel guns for the State of Massachusetts. The trunnion pieces were of cast iron, weighing about seven tons each. From the faces of these pieces remarkably long chips were cut, not coiled so much or so closely as the one you show. The old tool dresser, who was an expert steel worker, would readily weld two of the pieces of a chip together, heating in his ordinary fire. This was the only instance in which I ever saw cast iron welded, although it may be common enough to others.

It may be of some interest to know that this casting was imported from England, and that after it had been secured to the face-plate of the lathe we found that no tool we could make, whether made of the best American steel or the best English steel we could buy, would cut it at all. The casting, therefore, hung upon the face plate (the lathe was a special one built for the job) until steel could be imported from England to do the work. American steel makers have made great progress since that time, and I have no doubt could now easily supply a steel as good as that we waited so long for in the early '60's. F. F. HEMENWAY.

Reciprocals in Business.

Editor American Machinist:

Perhaps because man is by habit acquisitive addition is an easier and a more familiar operation than subtraction, and multiplication than division. The operations of multiplication and of division are always interchangeable, and the same results may be accomplished by the use of a certain factor in the one case or of its reciprocal in the other, and because multiplication is an easier and a quicker operation than division it is usually preferable to employ it. A great number of the computations which mechanics and engineers have occasion to make involve the employment of certain constants, sometimes as multipliers and at other times as divisors. In these operations multiplication might always be employed and division avoided if the reciprocal of the factor were at hand and ready for use. The various engineers' pocketbooks should invariably give the reciprocal of every multiplier or divisor which they supply.

The use of the reciprocal in figuring is here advocated merely as a time-saving and labor-saving device. It is only claimed for the reciprocal in figures that precisely the same result is secured by it with some appreciable saving of labor. More than this can be said in favor of the cultivation of a habit of reciprocal thinking on things in general. The two sides that there are said to be to every question are often only the reciprocals of each other, and yet until they both are considered we cannot judge fairly. It is proper and necessary for us all to look out for ourselves and to claim as our own all that our hands can reach. We must always insist upon all of our rights, but still "put yourself in his place" is the grand and mighty reciprocal which alone accomplishes the full measure of justice.

Now to come right down to things mechanical, as we are generally in the habit of doing in the columns of the "American Machinist." I have in mind a case where the use of the reciprocal has been wofully neglected, and with most disastrous results. I feel a little delicacy about speaking of this matter, and yet I do not know why I should. I see no possibility of doing any harm to anyone, while there is some chance of doing some good.

I dropped into a shop the other day to make a little friendly call. The shop was a regular machine shop, and might almost be called a typical small shop. There were in the shop all the usual tools, none of them of large size; two or three lathes, a planer, two shapers, universal miller, upright drill, cutter-grinder, etc. There was good bench room and unusually good light. I do not know how long the shop had been in operation, but I believe ten years or more. The proprietor, whom you would hardly call an old man, is indisputably an excellent mechanic. He is not only an excellent workman, but he is an ingenious designer of machine tools. He builds, for instance, a small screw machine that is not surpassed by any machine within my knowledge for speed or precision or for wearing qualities. He makes also several other excellent machines, such as are in demand for cheap duplicate production in the most enterprising shops.

When I called this man was literally and actually "boss and all hands," with not a single stroke of work to do. People may have different ideas, pessimistic or optimistic, as to the present state of the machinist trade, but I know lots of shops that have plenty of work, and many shops that are running overtime. When I find such a shop in such a condition at such a time as this I cannot help asking, What's the matter? I know that when it comes to manufacturing the small shop has not always a fighting chance against the big manufactory, but the small jobbing shop, the experimental and model-making shop, or the shop for making small specialties, will always be wanted, and will never be superseded. This shop of which I speak was in a building with a lot of other shops which are all doing pretty well and expecting to do better, yet it is absolutely dead and worthless today, with no apparent future. The proprietor is perfectly frank in his interpretation of the situation. He says that he cannot get living wages for his work. He cannot afford to build his special machines for the prices that customers are willing to pay for them. I have no doubt that this is a tolerably correct statement of the situation.

Now here, it seems to me, is where the function of the reciprocal comes in. If this case were stated the other way, or looked at from the other end to, it would be made to look very different. As it stands, and as the case is stated, the shop is all right and the rest of the world is all wrong. Suppose that instead of saying, "I cannot get living wages for my work" he should say, "I cannot work as cheaply as others are glad to work for. I cannot sell my machines because I cannot build them cheap enough. I cannot build them and pay running expenses for prices at which others build them and make money." This would state the case as truthfully as before, and at the same time it might stimulate healthful thought. If the shop is to be run on the lines of a quarter of a century ago, or even of ten years ago, it is to be remembered that those lines are not straight. They curve downward and run into the ground. Many shops have been very neatly run into their graves on these easy ways. Work cannot be made with profit for either the maker or the customer by cutting and trying. We may have the finest of all tools and the most skillful and

faithful of men to run them, but the greatest of labor-savers are the drawing-board, the T square, a pair of triangles and some compasses. I saw none of these things in the shop of which I speak. I did see one copy of the "American Machinist," that twentieth birthday number, which I was told had been left in the shop by a mechanical acquaintance.

TECUMSEH SWIFT.

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Pumps.—Inside Connected and Inside Packed.

Editor American Machinist:

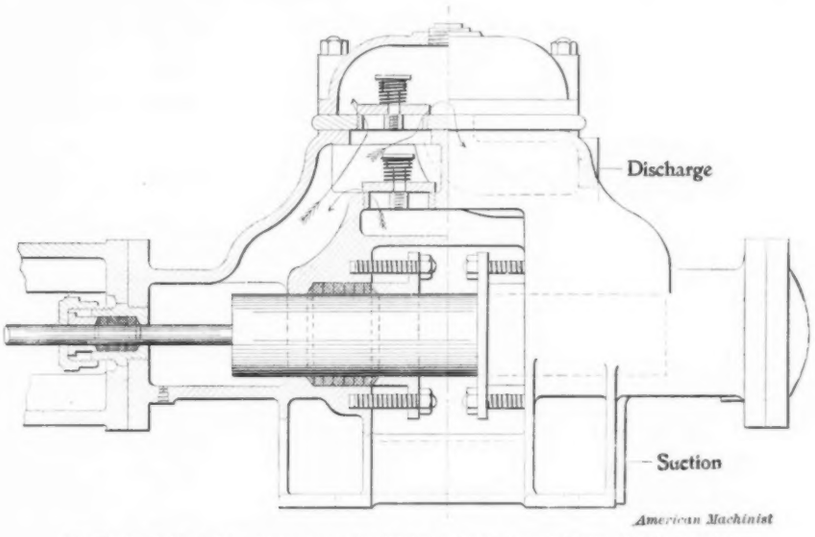
It was with much interest that I read Mr. Ferris' article on pump packing in the January 6 "American Machinist," and would like to suggest to him that there is another side to this question, and one that he has probably overlooked. His trouble is not with the pump or with the packing, but is due to the fact that he is using the right pump in the wrong place.

Until a few years ago the inside packed piston or solid plunger pump was the principal type of machine built for feeding boilers and for general pump service up to 125 to 150 pounds pressure per square inch; and be it said to the credit of this type of pump that there are thousands in use to-day that are giving excellent satisfaction.

With a proper fiberous packing, suitable for hot water and such as all the principal pump builders now furnish with boiler feed pumps, they will "pump and keep on pumping" for six months at a time with practically no attention whatever, if the water is reasonably clear and free from grit. The pump builders, like all other people, aim to give their customers what they want, and as nine times out of ten the purchaser wants the cheapest thing that he can get hold of that will pump water, the regular inside-packed piston or solid plunger pump is bought. If, however, the boiler pressure is extra high or the water gritty—if advice is asked from one who knows—an end-packed four-plunger pump may be recommended. This is the regular pressure pump style, and costs perhaps twice as much as the cheap inside-packed pump, such as he is using, but possesses the advantage of being readily packed and kept tight.

During the last few years all the prominent pump builders, recognizing the necessity of a better pump than the regular piston pattern, and at the same time one not so expensive as the end-packed style as above mentioned, have placed on the market what is called a "Center-Packed Pump," a sectional elevation of which accompanies this letter. This pump has a single plunger, working in the stuffing boxes, and is compact, accessible and reasonably cheap. As regularly designed, it can be used for pressures up to 250 pounds, requires very little attention and is not liable to give trouble in any way.

When a customer wants a real good pump and is not afraid of a trifle extra expense (which, by the way, is the exception and not the rule) we always recommend this style.



WATER END FOR DUPLEX, CENTER-PACKED BOILER FEED PUMP.

In regard to the pump shown in Fig. 4, no self-respecting pump builder, in these days, would be guilty of such a construction. It is true that this pump may be kept apparently tight by the outside glands, but the wear in the internal diaphragm cannot be prevented, and in a short time the pump will be by-passing half its water, and no one will know where the trouble lies until the machine is taken apart. Then it is necessary to make a difficult and expensive repair by inserting a new diaphragm.

The floating stuffing box, shown in Fig. 7, is expensive in first cost, and though reasonably effective, is troublesome to change, on account of being entirely inside of the pump barrel.

In regard to valve seats, the tool that is shown in Fig. 6 is what we all use, and all valve seats are faced off after being screwed into the decks, which insures a smooth bearing for the valve.

I do not think that there is another class of machine builders who cater to such a variety of ideas and notions as pump men, and our constant aim is to give a man just what he wants and is willing to pay for. We are making regularly six different types of boiler feed pumps, and some of the other prominent builders have one or two more. The catalogs of any of the leading makers will show pumps for any and every possible condition; and after all the selection of a pump simply revolves itself to this: You pay your money and take your choice.

If, however, the conditions that are to be met are clearly given to the pump makers they will recommend a pump which from their point of view will be best suited to meet these conditions; then, if the customer buys something cheaper, and it is not satisfactory, he has simply himself to blame and not the pump builders.

WM. C. MCLEOD,
Superintendent Buffalo Steam Pump Company.

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Too Thin—A Faulty Pipe Fitting.

Editor American Machinist:

The inclosed is a fragment of an extra heavy cast-iron elbow. Its appearance may belie the statement, but it is a fact, nevertheless. It had been in use about three years subject to a pressure of 200 pounds. The thinnest part found was but five-one-hundredths of an inch thick. The opening that was found in the elbow was oblong in shape and had an area of one and seven-tenths square inches. The trouble was caused by the core getting to one side, as the metal on the opposite side was eleven-sixteenths of an inch thick. It was used in connection with separator piping, and located so that the opening threw hot water and steam onto a dynamo belt which promptly came off, bringing other troubles in its wake.

It is not very reassuring to know that this fitting was cast, machined, inspected (?), shipped to dealers, sold, shipped to destination and put into use by supposedly good and careful mechanics, without anybody discovering its dangerous condition. It is but fair to say, however, that the outward appearance of this fitting in shape, size or weight, was not different from any other of its kind.

PETER H. BULLOCK.

[The inclosure referred to by our correspondent is a piece about ¾x1 inch,

from the side of a cast-iron elbow, probably not less than 3 inches. The piece tells its own story, and very clearly. The thinnest part of it is rather under the figures given above, while the thickest end is about one-eighth of an inch. The core evidently was not properly secured and floated up when the elbow was poured. There must certainly have been someone at fault at the foundry. As we have handled a great many pipe fittings we cannot think it possible that this particular one could have been handled without suggesting to more than one person that it was out of balance and did not feel just right in the hand. Probably those who did detect the fault did not realize how bad the case was, and it must be tolerably certain that no one actually measured or tested the elbow. Many tests that might have been applied will readily suggest themselves. If the elbow had been merely stood up on the center of the curved part its haste to tumble over would have told the story. Long-legged calipers might be employed for measuring the thickness of the body at different points. A three-lever balance might be devised, upon which, if the elbow was laid, any abnormal distribution of metal would be instantly indicated.—Ed.]

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Change Gears for Screw Cutting.

Editor American Machinist:

Articles on change gears for screw cutting, such as appeared in the issue of December 30, and also at other times, always interest me, as I suppose they do almost every machinist, especially those who consider figuring change gears almost a mystery.

There are plenty of rules for figuring gears, so what I have to say may not be new, yet it might help someone who, like myself, cannot remember a lot of rules unless they have constant use for them. Your answer in November 4, on single geared lathes, is practically the same that I used, only in a different order, and my way does not give fractional results. I usually select one of the smallest gears used for driving and which is divisible by the number of threads per inch of the lead screw. Having made this division, multiply the number of threads wanted by the result, and the answer is the gear needed for the screw. Suppose the lead screw is 6 and we select 24 for a divisor, and wish to cut 14 threads, then $24 \div 6 = 4$; $14 \times 4 = 56$, which is the gear wanted. That is, of course, in a case where the stud revolves as many times as the lathe spindle.

Another scheme that I use for cutting threads not indicated on the index plate works well on a lathe where all the gears are interchangeable; on stud, screw, or intermediate stud; of which the Ames lathe is a good illustration. The intermediate stud carries a feathered sleeve long enough to accommodate two gears, and the screw has a collar or small blank gear, which can be put on ahead or back of the gear to change its position to accommodate direct gearing or compound. A way which looks simple is to select a thread just one-half the number of the thread wanted and then compound with two gears, one of which is one-half of the other; but my experience has been that those gears would not always mesh, as the large one would strike before the small one was close enough to mesh. But I use the same principle. Suppose the index plate reads to 32 threads and, for that pitch, calls for 24 and 96, which are the smallest and the largest gears in the lot. It may happen that I want 40 threads, so, in that case, I use those gears for 32. But 32 threads are thirty-two-fortieths, or four-fifths of 40 threads; so I select two gears of that ratio to each other, which are, say, 48 and 60 for the compound, running 24 onto the 60 and 48 onto the 96.

But that will not work on lathes with unchangeable intermediate gears. I mean where only one and the same gear is used for the intermediate.

Lathes built with gears interchangeable give one an infinitely larger range of threads, and, it seems to me, should be adopted by all lathe builders, especially on smaller lathes. A. D. Mc.

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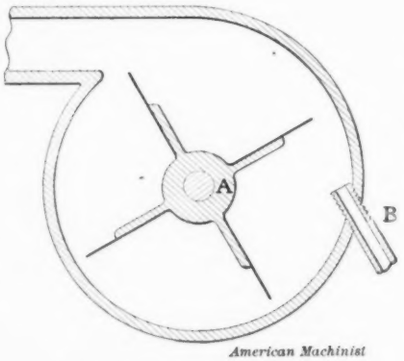
Compressed Air Blast.

Editor American Machinist:

An interesting application of the use of compressed air is that of the Fallbrook railway shops in furnishing a blast for the boilermakers' forges. The driving rig was removed from an ordinary portable forge and the nozzle *B* was screwed



COMPRESSED AIR BLOWER.

in the shell so that the air current would impinge on the vanes of the fan *A*. The amount of throttle opening required is very small to drive the fan at a high rate of speed, so that it is remarkably economical of air. The blast furnished is almost an ideal one for this purpose, and one capable of the closest regulation. It is one of a number of interesting shop appliances designed by Assistant Superintendent C. R. Williams.

Fred. E. Rogers.

Corning, N. Y.

[It seems proper to call special attention to this simple device. We have known several cases, principally at mines, where the entire blast for a drill dresser's forge has been taken direct from the compressed air pipe leading to the rock-drills. This is a very wasteful way of using compressed air, and the power which it represents. By the device illustrated above the compressed air supplies a blast of many times its own volume, and with all the pressure required.—Ed.]

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Stay Bolt Making in the Turret Lathe.

Our railroad readers do not need to be reminded of the fact that common practice in connection with locomotive fire-box stay bolts is simply barbaric. In the "good old days," which are still with us on many roads, these bolts were threaded from end to end on a common bolt cutter, with more or less, and usually more, error in the thread before the bolt was finished. When finished the bolt was expected to enter holes independently tapped in the two sheets. To get such bolts to enter the bottom sheet and go home, it is no unusual thing to see a 3-foot wrench used, liberally assisted by the sledge hammer applied to the sheets, although the bolts may be a free fit in the holes if entered into the two sheets one at a time. It is plain enough that the result is a buckling strain on the sheets, while some of the bolts will be under initial tension and others under compression. When steam is raised the bolts which are under tension take all the load due to the steam in addition to their initial strains, and they cannot be blamed for sometimes letting go. Of late the upset bolt, threaded only on the ends, and with the middle portion smaller than the roots of the threads, has come into use, and to preserve the continuity of the threads at the two ends, lead-screw bolt cutters are used. With these, taps having a controlling thread on the shank to enter the thread of the outer sheet before the tap threads enter the inner sheet are used, and if the bolt threads and the tap threads agree all goes well, but if they do not, the old barbarous state of things continues.

The accompanying illustrations show a new method of making stay bolts by which it is reduced to a turret lathe job, while the second thread is made a true continuation of the first.

The turret of the flat turret lathe offers no obstruction to the passing of a long piece of work clear across it. On it

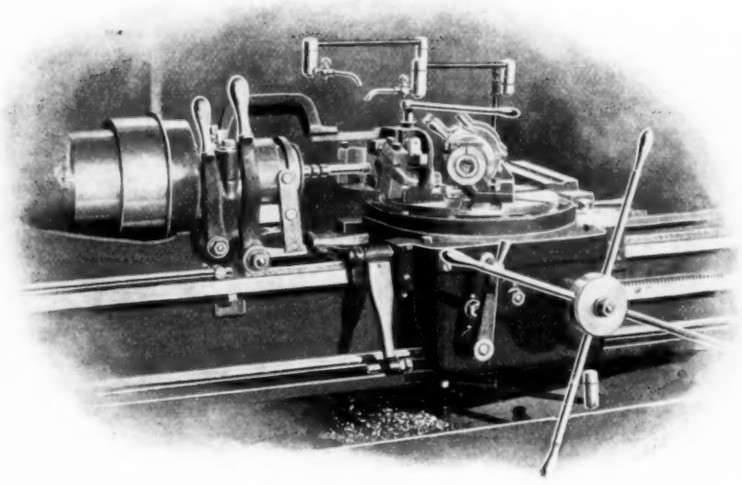

FIG. 1.—TURNING THE NECK.

two die heads may be mounted in line with one another, and, with opening dies, the leading one may be opened and slid past the first end and the neck of the bolt, so that both threads may be cut simultaneously.

By this method the bolts are made from the bar direct, the machine being fitted with roller chuck, so that the work is handled as expeditiously as any turret lathe job made from the bar. Fig. 1 shows the bolt after necking down the center, which is the first operation, the turning tool being shown as still in position. This tool is first opened and slid over the first end of the bolt, when the taper turning attachment seen mounted on the yoke which spans the chuck comes into action and forms the first fillet with an easy curve. The neck is then turned straight, and, finally, the second fillet is formed in a similar way, when the tool is opened and withdrawn. In the second operation the leading die is opened and slid over the first end of the bolt, when it is closed, and the two dies, which are in line, take hold together and cut their respective threads. The final operation is of course the cutting off. The location of the two dies in line is better seen in Fig. 3, where the bolt being made is longer and the dies are farther apart. In this case the distance between the dies is too great for both of them to be mounted on the turret, and the rear die is consequently placed on an extension bar mounted on the back side of the carriage. This bar will also be seen in Fig. 1, folded out of the way.

Spotting places are provided on the dies, by the insertion of distance pieces, between which the dies are spaced at a distance apart to make the second thread a true continuation of the first.

In case the threads at the two ends

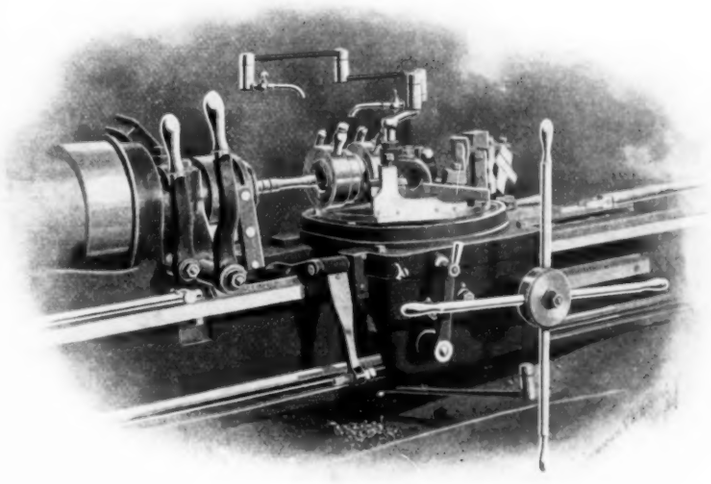

FIG. 2.—TANDEM DIES IN POSITION FOR THREADING.

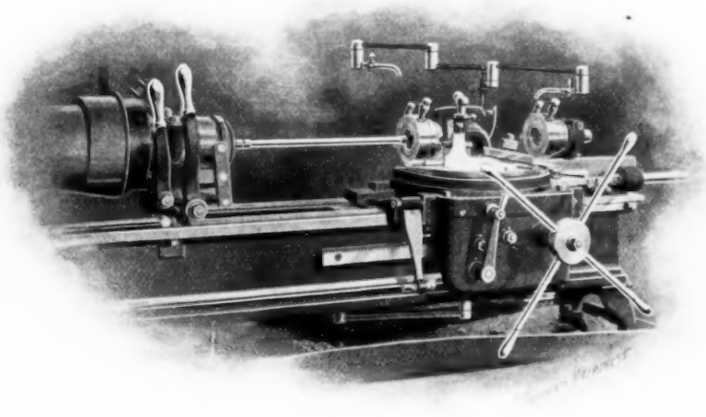

FIG. 3.—THREADING A LONG BOLT.

of the stay-bolt tap are incorrect, the tap may be entered in the dies when one of them is loosened on the turret. The jaws may then be closed on the tap and the die head be bolted down, and thus set, the dies will cut bolts to suit the tap, no matter how much out it may be. The original idea in connection with this method of making the bolts was to follow this plan, but it has the disadvantage of requiring bolts to be made for each tap and of requiring these different bolts to be kept separate, and, furthermore, bolts and taps must not get mixed. Consequently Mr. Hartness considers it best to devote his attention to making correct bolts. The taps are now made much better than formerly, and with good taps the bolts can be made in quantities and good results secured.

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Guarantees for Machine Tools.

If a pumping engine for a city water works is to be built, or a warship, or an ocean liner, it is a custom approved of experience that precise guarantees shall be exacted as to their performance, and that careful tests shall be made before acceptance. So many gallons of water shall be pumped for a pound of coal, the ship shall make so many knots, usually without question as to coal consumption. So, if a locomotive, or even a stationary engine or a boiler, is to be sold the builder is always ready with his definite and precise statements of what shall be accomplished under stated conditions, and the purchaser sees to it that the performance fulfills the promise. This is merely the enforcement of practical common-sense business methods. Specifications as to performance are always in order where the work to be done can be accurately defined and measured, as it usually can be in the cases alluded to above.

It is a most natural, if not an inevitable, suggestion that similar guarantees shall be embodied in contracts for machine tools, and that formal tests shall determine whether the guarantees are fulfilled. There are those who are disposed to regard lathes and planers as simply chip-producing tools, and it is even proposed in some quarters that specifications shall state the weight of material which the tools shall remove in a given time. The general inapplicability of such tests must be evident to those who have experience in the use of such tools. There may be cases where such tests would be applicable, but there must be more in which they are not. Perhaps the majority of lathes, for instance, pass their entire existence without an opportunity of employing their heaviest cutting capacity, just as a pianist might never know how much he could lift. General handiness of operation is usually worth more than actual cutting power, although in many cases the latter may be the most essential. Even where heavy cutting must be done there must also be light and accurate cutting for finishing. All-round precision in a tool is in more frequent and general demand than strength alone. The two properties must, however, usually accompany each other. Strength means stiffness, and there can of course be no precision of alignment or of tool movement, and especially no maintenance of precision, without it. The specifications which assign the limits of error permissible in a lathe spindle, the tests for which are to be made without load or strain, are incomplete, and do not accomplish what they are designed to. The same may be said of all quiescent tests of tools designed for heavy work. They may be the best tests that are practically possible, and they may accomplish a certain purpose, but they cannot be conclusive. We may test the spindle of a large lathe and its face plate and ascertain their approximate accuracy. We may then bolt a heavy piece to one side of the face plate, having it hang out from the plate a long distance and balance it, as the custom is, by a piece bolted close to the plate on the opposite side. It would be a wonder of a lathe that would maintain the original accuracy under such conditions. All the parts of the lathe must yield in a similar way under working or carrying strains. The difficulty of devising any satisfactory and conclusive preliminary tests for machine tools is more apparent the more the subject is considered. There is no test like the test of every-day work. It is not the tool that can cut the biggest chip, nor the tool that can make the greatest weight of chips in a day, but the tool that can turn out in a year the greatest amount of the best work that is most to be sought for.

Tests of alignment show degrees of accuracy in workmanship, but do not necessarily show which is the best tool for all purposes. In other words, while tests will show what they are designed to show they cannot show all we ought to know about a machine-tool, and usually nothing but experience in actual service will do that.

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The Bessemer Steamship Company, of which Mr. F. T. Gates is president, has named one of its new ore-carrying steamers the "John Fritz," in honor of the work and achievements of the past president of the American Society of Mechanical Engineers in the development of metallurgical processes. We think this action is especially to be commended, the more so in view of the fact that the mechanical engineer seldom receives credit for his work which is due to it relatively to the credit bestowed upon the work of others. For instance, Mr. Fritz's name is not identified or connected with any of the great works which he has been the practical creator of, and he is practically unknown therefore outside of the profession, notwithstanding that humanity at large has been very greatly benefited by his work.

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One of the things which some of our foreign friends find it difficult to understand is the fact that practically all American machine-tool builders are represented in our advertising columns. A foreign firm writes us for names of American builders of lathes, milling machines, boring machines, etc. We reply that we are mailing to him a complete list of such names every week. Sometimes he does not believe this, and writes to the Philadelphia Museum, perhaps, for other names, only to find that what we have told him is literally true, and that a foreigner who reads the "American Machinist" need look no further for American machine-tools.

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Henry L. Pierce, of Boston, by his will left to each of the employés of his chocolate factory at Dorchester, Mass., without distinction as to length of service, and without condition or advice, $100. These legacies, amounting to $43,000, were recently distributed at a dinner at which there was much speech-making. It is pleasant to be able to record that the relations of Mr. Pierce with his employés were always pleasant and helpful in his lifetime.

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In regard to the report that a new variety of pig iron had been discovered at the magnetic extracting works of Thos. A. Edison, that gentleman is quoted as saying: "The only thing is that in turning out pig iron at the Edison mines a few weeks ago we discovered that a few thousand tons possessed unusual strength. I had it analyzed to find out what caused this strength. I found out. I haven't told anybody the cause. I don't intend to."

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The pitch of the ways for the launch of the Japanese cruiser "Kasagi," at

Cramp's shipyard, on January 20, was 13-16-inch to the foot. The weight per square foot was 2 1-3 tons, and the total weight 2,396 tons. Six barrels of lard-oil mixed with 4,000 pounds of tallow were used for lubricating the ways.

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Foreign Trade.—Spending Money Abroad.

Mr. Chas. Davis, president of the Davis & Egan Tool Company, of Cincinnati, Ohio, was recently tendered a complimentary dinner at the Manufacturers' Club, of Cincinnati, on which occasion he delivered an address, treating broadly of our growing export trade in machinery and what in his opinion is needed in order to develop this trade.

His remarks were evidently based upon recent extensive European travel and careful study of commercial conditions on the other side, and those on the subjects of politics and its influence on business, our habit of over-confidence and of pluming ourselves upon our great superiority in all respects to the peoples of European countries; on the importance of improving the consular service, and of the study of foreign languages, are well worthy of careful attention.

We notice, however, that Mr. Davis falls into what we regard as a very commonly accepted error wherein he says: "We spend too much money in Europe every year for pleasure. It is estimated that two hundred thousand persons cross the ocean yearly from the United States. Placing the average sum expended by each at $1,000 (which is conservative), we have the enormous total of $200,000,000." We think Mr. Davis will probably revise his views on this point if he will stop to think just what happens when he, for instance, goes to Europe. He will then perceive that he takes no money abroad with him, but deposits his American money in a bank, at Cincinnati or New York, taking in place of it a letter of credit, by means of which he draws money in European countries as he may need. This is not American money; but is English, German, French or Russian money, and the amounts thus drawn becomes a charge against some American bank or banks, and that charge or that indebtedness of American banks to foreign banks is finally liquidated by our exports of farm products—wheat, potatoes, meats, etc., and of manufactured articles, including machine tools. In other words, when an American goes abroad and spends money, his clothes, food and other things which he buys there and which represent the product of labor and capital devoted to their production in foreign countries, must be paid for by the products of American labor and capital devoted to the production of things which are exported, and this export trade we believe is what most Americans are trying just now particularly to promote.

Death of Burr K. Field.

Last week we mentioned the death of Mr. Burr K. Field, vice-president of the Berlin Iron Bridge Company. Mr. Field was born in 1856, and graduated from the Sheffield Scientific School in 1877 as a civil engineer. He was then employed for some years in railroad work, principally on the Northern Pacific. In 1882 he was appointed Superintendent of Bridges of Philadelphia, holding that position about a year, when he became assistant engineer of the firm with which he was thereafter continuously connected. His advancement in the company was rapid, and he had no small part in the development and upbuilding of the great establishment. He was an indefatigable worker in his business, and active and energetic in public life. He died quite suddenly, having been ill less than a week.

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Personal.

Chief Engineer A. Kirby, U. S. N., is detached from the "Baltimore" and ordered to the Naval Hospital, Mare Island.

Chief Engineer F. A. Wilson, U. S. N., is detached from the Union Iron Works, January 20, and ordered home and to await orders; will be retired February 7.

Mr. C. H. Buckley, late of McIntosh, Seymour & Co., has accepted the position of foreman of machine shop of the Phœnix Iron Works, of Port Huron, Mich.

Richard H. Scott, formerly with the Harris Automatic Press Company, of Niles, Ohio, has accepted a position as general foreman with the Toledo Machine Tool Company, of Toledo, Ohio.

Owing to the removal of the auditing department of Westinghouse, Church, Kerr & Co. from New York to their Pittsburg office it became necessary for Messrs. Warren L. Murray and Gardner W. Kimball, of that company, to remove to Pittsburg, and before their departure they were given a complimentary banquet at a prominent restaurant in New York, on which occasion the entire office force of the company was present, and it was made a very pleasant occasion.

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At this writing the end of the great engineering strike and lockout in Great Britain seems at hand. The Executive Committee of the Amalgamated Society of Engineers has recommended the acceptance of the employers' terms and this seems likely to be done by a ballot which will take place Thursday, the 27th inst. If the employers' terms are acceded to there will be, we think, a much increased demand in Great Britain for American machine tools, though readers who have followed our discussions of the situation over there will not conclude that the last obstacle to the introduction of American tools has been removed.

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Commercial Review.

NEW YORK, Saturday Evening, Jan. 22, 1898.

MACHINE TOOLS.

The extent to which orders for iron working machinery are being received at sales offices in this city is most encouraging. The majority of the manufacturers' agents with whom we have conversed are in excellent spirits and this based not merely upon expectations for the future, but upon the orders which have already been received.

The sources of business are such as indicate a healthy revival of manufacturing industry. They are not limited to any particular line of work and they come from "Texas and elsewhere." One seller remarks to us that the class of customers he has particularly noticed are old shops which are being fitted up to compete with new.

Of course the equipment of bicycle manufactories is now hardly a feature of trade in this country, but the boom has not yet subsided in Europe. One large company in this city which has made especial effort in catering to the foreign bicycle machinery trade informs us that this is yet brisk and that new shops are still being started for bicycle manufacturing.

Very few machine tool manufacturers have yet had the hardihood to stiffen up on prices. It is to be hoped that they will soon feel that they are in a position to demand reasonable compensation for their goods, which it is certain that in many cases they now fail to receive. One concern is doing it already, but as this one is overwhelmed with foreign orders it can afford to be dignified toward domestic purchasers. "It is quite a general thing," remarks the representative of this concern, "that 14-inch lathes are now sold as low as $175. But we sold two of them this week, for which we received $215 and $205 respectively. We would not consider an offer of less than $200. Why should we, when we can sell abroad for from $200 to $220 as many as we can make for the next ten months?"

A traveling man of an Eastern tool company passed through Pennsylvania just before the holidays and laid the foundation of a good business, which has since come in. He was much impressed by the cheerful aspect of affairs in that State, and also around Youngstown, Ohio. On the other hand he has lately been traveling from Albany to Buffalo and considers the situation in New York State very dull. Upon the whole, he is much pleased with the condition of domestic trade, although his company has not received quite so many foreign orders lately as formerly. Its shops are

now some sixty days behind hand with orders.

Another man who has been on a trip through Pennsylvania does not agree that everything there is one grand, sweet song. He found it busy and dull in spots. There was some activity left around Williamsport. Pittsburg seemed hardly to be having its share.

As to the situation up New York State, also opinions differ. A representative of the "American Machinist" was in the Western part of New York about the first of this month and the Gleason Tool Company, of Rochester, spoke of business as much improved, with an excellent outlook. Other lines of industry in Rochester were reported much better employed than recently.

We understand that the Ferracute Machine Company, Bridgeton, N. J., is now busy. Its force in 1897 was 25 per cent. larger than in 1896.

The L. S. Starret Company is behind-hand with its orders. It is unable, with present facilities, to execute them as fast as it would like. This is particularly the case in regard to small tools, such as measuring instruments, calipers, etc. Its business in this neighborhood was particularly brisk for the first week or two of this year. Both foreign and domestic trade are good.

A man on the road for another large manufacturing establishment in the same line as the above reports business fair and rather improving.

EXPORTS OF MACHINERY.

According to the "Monthly Summary of Finance and Commerce," published for November, 1897, by the Bureau of Statistics of the United States Treasury Department, exports of metal-working machinery for the month amounted to $360,329, and for the five months ending with November $1,588,845. The figures

Continued on page 35.

Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Pow hmrs. mfd. by Jenkins & Lingle, Bellefonte, Pa.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Conn.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y

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Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

First-class vise hand wants pos'n. Box 29, AM. MACH.

First-class draftsman and designer, tech. graduate, with six years' best exp. Box 37, AM. MACHINIST.

Mech. draftsman and mchst.; exper. steam, marine pump, gen. mach.; desires position. Box 18, AM. MACH.

Wanted—Situation as foreman patternmaker; 20 yrs. exp.; 5 years foreman; best of ref. Box 30, AM. MACH.

Wanted—Position as manager or superintendent of factory by a practical, up-to-date mechanic; first-class references. P. O. Box 1533, New York.

Mechl. engineer, ten years' experience; railways, power transmissions, steam, water and air; good shop-man and mgr.; wants per. positon. Box 48, AM. MACH.

Expert mech. draftsman, competent young man, wants position in eng. capacity; salary secondary consideration; first-class ref. Address Box 22, AM. MACH.

Mechl. draftsman, Swede, technical graduate, 8 1-2 years' exp. this country, wants position; stm. eng. and genl. mach. preferred; terms mod. Box 45, AM. MACH.

Wanted—Position as foreman in shop or mfg. co., by first-class tool maker and dr'sman; can design all small tools; 10 yrs'. exp. as foreman. Box 38, AM. MACH.

Situation wanted by draftsman and designer; 9 yrs'. experience; automatic machinery, tools, engines, boilers, and use of steam eng. indicator. Box 44, AM. MACH.

Situation wanted by first-class toolmaker; experienced on cutting, forming and drawing dies, jigs, gages, etc.; accustomed to design, also handle help; references. Box 43, AMERICAN MACHINIST.

Brass foundry foreman wants situation; understands all details in running shop, mixing metals from old and new stock, and a good manager of help; first-class references. Box 42, AMERICAN MACHINIST.

Situation wanted as foreman, master mechanic or any capacity requiring the services of a first-class mechanic; exp. in marine and stationary work; vicinity of New York preferred. Box 32, AM. MACHINIST.

A thoroughly practical mechanic with extensive exp. in the handling of foundries, mach. shops, etc.; in electrical, eng., power transmitting mach. and various other lines desires a position as supt. or manager; salary or share. Address Box 33, AMERICAN MACHINIST.

Engineer of large experience in the design, manufacture, construction and operation of steam and elec. mach. and plants, desires engagement; built some of largest plants in U. S.; highest references; moderate salary; will go anywhere. Box 46 AM. MACHINIST.

As supt. or m. e.; a thorough technical education and 12 years practical exp. on general mach. work, heavy mach., tools, automatic mach., high grade special mach., drop forge, punch press, die and jig work; at present mech. eng. for one of the largest mfrs. in New England. Box 23, AMERICAN MACHINIST.

Situation wanted as sup., asst. or general foreman of mach. works or factory. Have extensive exp. in man. the manufac. of general and wood-working mach., machine tools and bicycles; well up in modern mach. shop practice, designing and drafting; successful in reducing cost and estimating. Box 47, AM. MACH.

A successful superintendent would like a change in April or May, 1898. A practical machinist and iron founder forty-four years old, twenty six years' experience, sixteen years as superintendent, seven years in present position. I invite the fullest investigation of present and past record, character, mechanical and executive ability; money not an object. Address Box 36, AMERICAN MACHINIST.

Engineer, 32, thorough tech. education; member A. S. M. E.; splendid experience as constructing eng. and manager, desires change; knows modern methods of mach. designing and shop practice; immense exp. on construction Corliss and other engs., air compressors, ice mach. and the most improved gas eng. practice; competent to assume charge of works of any magnitude; pos. as gen. supt. or chief eng. wanted; highest testimols. from all past employers. Box 20, AM. MACH.

Help Wanted.

Draftsman—Mechanical draftsman wanted on tool and jig work; man with shop experience preferred; state references. Box 41, AMERICAN MACHINIST.

Wanted—An expert workman on mathematical instruments, assay balances or microscopes; must understand all kinds of brass finishing, and mixing and applying lacquer; first-class men only need apply; answer stating exp. and by whom last employed; also wages expected; factory out West. Box 31, AM. MACH.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Job lot radiators, 12 1-2c. ft., S. M. York, Cleveland, O.

Book, Dies & Die Making, $1. J. L. Lucas, Prov. R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Wanted copy of Nov. 11, 1897, issue AM. MACHINIST; state price. Box 40, AMERICAN MACHINIST.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Wanted—Air compressor for pneumatic tools. Send catalogue to S. Wilks Manufac. Co., Chicago, Ill.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Schumacher & Boye, Cincinnati, O.

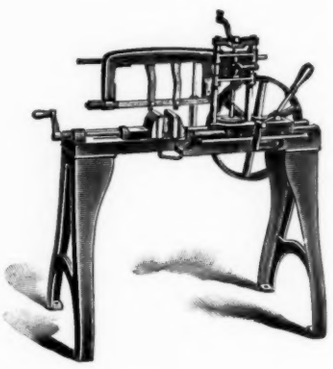
Wanted—A mechanic with about $1,500 to invest in a general machine shop. For further particulars address Box 39, care of AMERICAN MACHINIST.

Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern and in first-class condition. C. C. Wormer Machinery Co., Detroit, Mich.

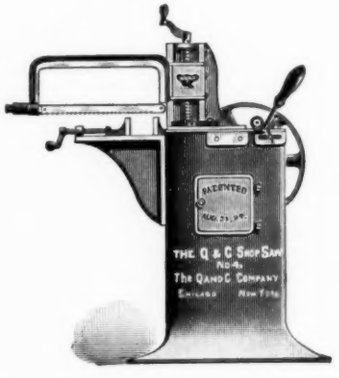
The

Q & C

Automatic Shop Saw.



Special Machinery For Cutting All Kinds of Iron and Steel Cold. . . . . .



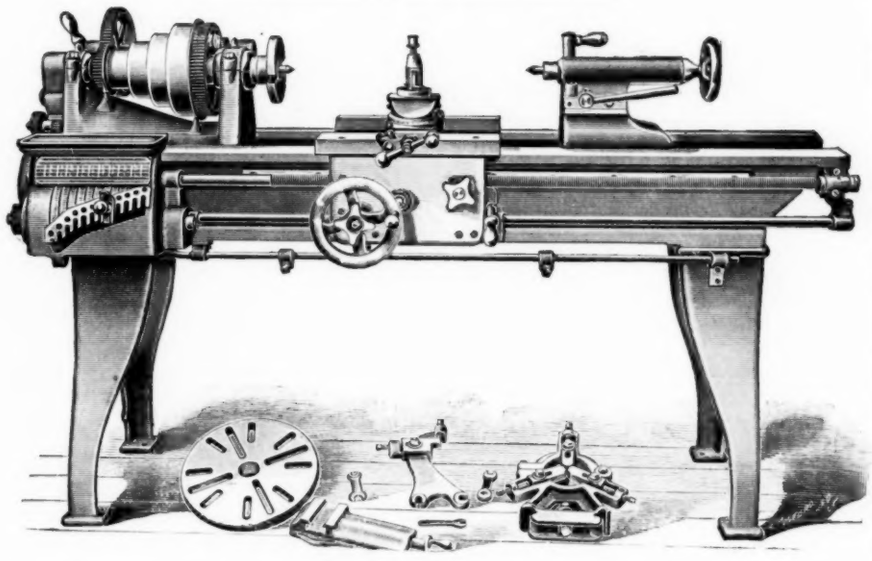
The Q & C Co.,

700-709 Western Union Bldg., CHICAGO, ILL.

100 Broadway, NEW YORK, N. Y.

537 Mission Street, SAN FRANCISCO, CAL.

THIS LATHE COMBINES THE LATEST AND BEST IMPROVEMENTS.



14 in. x 6 ft. Hendey-Norton Lathe

With Improved Automatic Stop.

• • •

AUTOMATIC STOP.

It is durable, simple, indispensable. It will automatically stop the carriage in either direction. It is equally efficient whether feeding or thread-cutting, running up to a shoulder, boring to bottom of holes, or internal thread-cutting. No danger of spoiling either tool or work. It is a safeguard against accidents in either direction.

CARRIAGE.

The carriage reverses in apron; no slamming of countershaft. There is no comparison between this lathe and the old style or common lathe.

THREADS.

It has all threads in daily use with simple movement of lever.

FEEDS.

Has all feeds in daily use with simple movement of lever.

Send for Circular.

• • •

THE HENDEY MACHINE COMPANY,

Torrington, Conn.

Agents for the Pacific Coast, PACIFIC TOOL AND SUPPLY CO., San Francisco, Cal.

J. W. CREGAR, Philadelphia Bourse Exhibition.

European Agents, SCHUCHARDT & SCHUTTE, Berlin, Vienna, Brussels, Stockholm. CHAS. CHURCHILL & CO., Ltd., London and Birmingham, Eng. ADPHE. JANSSENS, Paris, France. EUGEN SOLLER, Basel, Switzerland.

Continued from page 34.

for October, 1897, had previously been reported $337,792. Electrical machinery exports were $171,668 for November, $661,581 for the five months, $116,794 for October. Pumps and pumping machinery, $138,044 for November, $776,884 for the five months, $135,804 for October. Shoe machinery, $55,732 for November, $323,334 for the five months, $103,283 for October.

Exports of other lines of machinery, which having been separately classified for a longer time permit of a more extended comparison, included: Locomotive engines, $167,983 for November, 1897; $223,520 for November, 1896; $427,649 for October, 1897; $2,915,060 for the first eleven months of 1897; $2,858,838 for the first eleven months of 1896. The figures upon stationary engines were: For November, 1897, $21,136; November, 1896, $23,319; October, 1897, $24,895; first eleven months 1897, $332,743; first eleven months 1896, $225,988. Upon boilers and parts of engines they were: For November, 1897, $94,581; November, 1896, $55,931; October, 1897, $73,964; first eleven months 1897, $622,497; first ten months 1896, $580,744. Upon printing presses and parts thereof they were: For November, 1897, $39,218; November, 1896, $134,689; October, 1897, $105,460; first eleven months 1897, $615,092; first eleven months 1896, $432,980. The exports of foreign machinery are not included in the above summary, but are trifling in value.

The export statistics for December, 1897, are not yet completely compiled at Washington. When they are there published we shall print some of them relating to machinery for the benefit of our readers. It may be said now, however, that the exports of merchandise for last year amounted to $1,099,000,000, approximately, against $1,005,000,000 for 1896, which was the largest year's total to date. The imports were $742,000,000, against $681,000,000 for 1896, and were less than in most late years.

According to a current newspaper report, the Central Underground Railway of London, England, has placed with the General Electric Company of this city an order for thirty-two electric locomotives, the largest order of its kind ever given. According to another the firm of A. S. Baker & Co., of the Produce Exchange, this city, and London, has recently closed a contract for 10,000 bicycles for shipment to Europe, deliveries to be made monthly during the season of 1898.

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Quotations.

NEW YORK, Monday, January 24.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 75	@	$12 25
No. 2 foundry, Northern	11 25	@	11 75
No. 2 plain, Northern	11 00	@	11 50
Gray forge, Northern	10 50	@	10 75
No. 1 foundry, Southern	10 75	@	11 00

Quotations continued on page 36.

Quotations continued from page 35.

No. 2 foundry, Southern..... 10 25 @ 10 50
No. 3 foundry, Southern..... 10 00 @ 10 25
No. 1 soft, Southern..... 10 75 @ 11 00
No. 2 soft, Southern..... 10 25 @ 10 50
Foundry Forge, Southern..... 9 75 @ 10 00

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.07½ @ 1.10c.; refined, 1.15 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.60c.

Cold Rolled Steel Shafting—Base sizes, from store, in small lots, 2.20 @ 2.30c.

Copper—Carload lots, Lake Superior ingot, 11c.; electrolytic, 10¾ @ 10⅞c.; casting copper, 10½ @ 10¾c.

Pig Lead—Carload lots, 3.60 a 3.65c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 14.00c., f. o. b.

Spelter—Carload lots, 3.90 @ 4.00c. for good brands, New York delivery.

Antimony—Fair wholesale prices on the various brands, 7¼ @ 8c.

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, 42 @ 43c.

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Manufacturers.

A machine shop and foundry are to be erected at Orestes, Ind.

The Colonia Sugar Factory, at Hueneme, Cal., is nearing completion.

At Charlotte, N. C., J. H. Crowley is building an addition to his mill.

Duncan & Spangler, of Hastings, Pa., are going to place new machinery.

The borough of Norristown, Pa., is about to install an electric light plant.

It is expected that Karl H. Katz, of York, Pa., will make additions to his plant.

It is expected that the mill of D. P. Campbell & Son, at Sangerville, Me., will be enlarged.

Hamilton, Carhartt & Co., of Detroit, Mich., are to make considerable additions to their plant.

The Indiana Mirror Factory, of Connersville, Ind., will be removed to Elwood, in the same State.

Messrs. Thomas Millen & Co., of Wayland, N. Y., will enlarge their cement factory at an early date.

The Phoenix Foundry, of Terre Haute, Ind., is to have an addition erected, and new machinery is to be installed.

The R. G. Peters Company, of Manistee, Mich., is planning to locate a planing mill at Benton Harbor, Mich.

The Aluminum Manufacturing Company, of Two Rivers, Wis., expects to build an addition to its plant in the spring.

The National Malleable Iron & Casting Company, of Toledo, Ohio, has contracted for the erection of an addition.

The General Electric Company is preparing plans for the erection of an iron foundry at its Schenectady (N. Y.) plant.

There is to be a new mill erected at Carlinville, Ill. The main building will be 40x58 feet and four stories high.

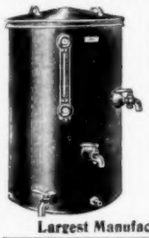
Gilbert & Co., of Mansfield, Ohio, are taking out a portion of machinery, which will be replaced by modern appliances.

Syracuse (N. Y.) University is to have a new hall of science erected, one part of which is to be devoted to machine shops, etc.

A new steel mill is contemplated at Cincinnati, Ohio. The Cincinnati Barbed Wire Company and H. Belmer & Co. are interested.

At Carson, Neb., the Carson Electric Light Company is to erect a plant. The incorporators of the company are William Hotze, David A.

THE CROSS OIL FILTER



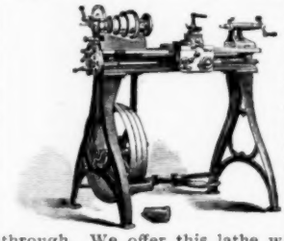
actually reduces oil bills 50% or more. Sent on approval. Used in 14 countries. Testimonials from leading firms in every field of industry.

Business established seven years

THE BURT MFG. CO.
AKRON, O., U. S. A.
Largest Manufacturers of Oil Filters in the World.

CASH BUYERS LIKE OUR PRICES.

The Sterling Screw-Cutting Lathe Swings 10 inches in diameter x 25 inches long; weight 400 pounds. The diameter of the foot driving wheel is large, which gives ease in running and is supported in adjustable boxes. The centers correspond to No. 2 Morse Taper. The head bearings are of composition bronze. The spindle has ½ inch bored through. We offer this lathe with either foot power or countershaft, substituting one for the other, including a 6 inch 4-jaw chuck, jaws reversible, six (6) lathe tools ¾ in. x ⅜ in. and two (2) dogs for $75 when cash accompanies the order.



THE FRASSE COMPANY,
17 Warren Street, New York.
The above with other bargains shown on our monthly "bargain sheet" mailed for a stamp.

GERMAN CATALOGUES.

All machinery is not sold through Ln catalogues. The O. K. kind is written or translated for shopmen by a shopman.

HENRY HESS,
Newport News, Va.

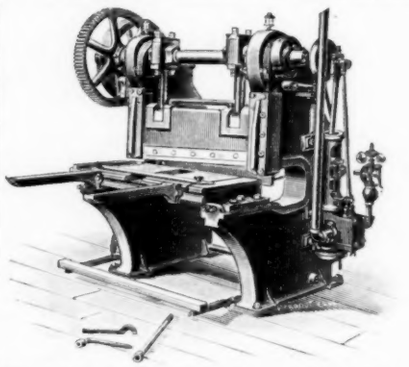
Finally, the problem of the ideal reversible Marine-Gasoline Engine is solved. Engine shaft connected direct with propeller shaft. No gears. No clutches. Works perfect and positive. Parties with means who desire to build the Future Engine for River and Ocean Vessels should address Reversible Gasoline Engine, American Machinist.

AUTOMATIC MACHINES
FOR MAKING
Stove Bolts, Tire Bolts, Rivets, Lag Screws and Wood Screws.

ASA S. COOK CO.,
Hartford, Conn., U. S. A.

We make and carry the most complete and best assorted stock in America. Our goods are recognized as the standard of quality. They all bear our trade mark and are warranted by us. Our prices are reasonable. Our lavishly illustrated catalogue minutely and correctly describes our goods. It contains much valuable information and is sent gratis on application.

PUNCHES, SHEARS, ROLLS and HACKNEY PNEUMATIC HAMMERS.



The Wais & Roos Punch and Shear Co.,
Cincinnati, Ohio, U. S. A.
SELIG, SONNENTHAL & CO., London.
SCHUCHARDT & SCHUTTE, Berlin.

BLUE PRINT STANDARDS
GIVE DIMENSIONS OF MACHINE DETAILS AND OTHER VALUABLE DATA. SEND FOR
FREE
DESCRIPTION AND LIST OF SUBJECTS.
R. FORTUNE FOOT OF WALKER ST., *DETROIT, MICH.*

We Want Small Tools
OR MACHINES TO BUILD.
First-class shop. Royalty or other terms.
U. S. METALLIC PACKING CO.,
425 North 13th St., Philadelphia, Pa.

IRON WORKING MACHINERY
AND ALL KINDS OF
MACHINE SHOP SUPPLIES.
COLCORD & SANDERSON,
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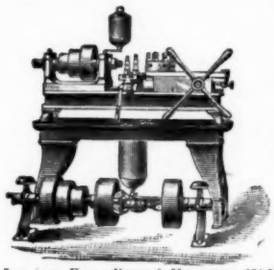

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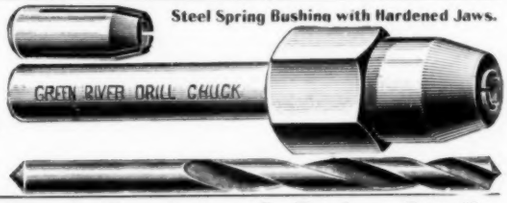

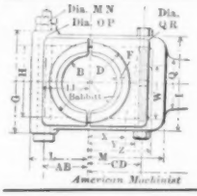

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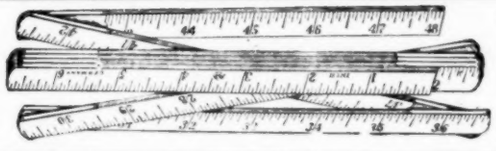

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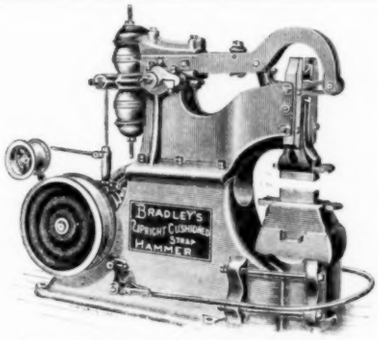

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Snapp. F. J. Reid is president and James S. Campbell is secretary.

Bowen & Reed, of Schuylkill Haven, Pa., are having their factory enlarged.

The Detroit (Mich.) Valve & Washer Company has been incorporated. James C. McIlroy and Horace G. Lohenstine are interested.

At Portland, Me., the C. W. Trainer Manufacturing Company has been organized for the purpose of doing a general asbestos business.

The Planet Manufacturing Company, of Holyoke, Mass., has been organized. J. C. Keough is president and F. L. Holmes is treasurer.

The Bullock Electric Company, of Cincinnati, Ohio, is contemplating the erection of a new plant to meet the growing demands of its business.

Simplex Engine & Machinery Company, of Chicago, has been incorporated to make engines, etc. F. W. James, J. Francis Small and W. D. Sherwood.

The Steel & Iron Metal Coating Company, of Chicago, Ill., has been incorporated. William I. Welder and William T. Mason are among the incorporators.

Mr. Fred H. Holton is erecting a building at Huron, S. Dak., which will be used as a foundry and machine shop. This shop is to be equipped with new machinery.

The Poster Coupler Company, of Muncie, Ind., has been incorporated. Albert M. Fox, Charles Foster, C. E. Lambert and James Boyce are among the directors.

At Ashland, Me., ground has been cleared and preparations are being made for the erection of a new hardwood mill. John F. Wilts, of New York, is interested.

The Michigan Foundry Company, of Detroit, Mich., has been organized. Among the incorporators are Frank Yanoth, Ed. Heinke and Herman D. Keller.

The Toledo (Ohio) Beet Sugar Company has been incorporated. The following are among the incorporators: Samuel M. Jones, Calvin Barker and George P. Sanborn.

The Pennsylvania Railroad Company has sold to John H. Shrite, of Philadelphia, property on Laurel street, that city, on which it is proposed to erect a sugar refinery.

It is reported that Mr. Potter, of Pawtucket, R. I., has purchased a tract of land near Norristown, Pa., on which it is proposed to erect a textile machinery manufacturing plant.

John Royle & Sons, of Paterson, N. J., will extend their works by the erection of an addition 100x45 feet. New machinery will be installed, including engine and boiler shafting, etc.

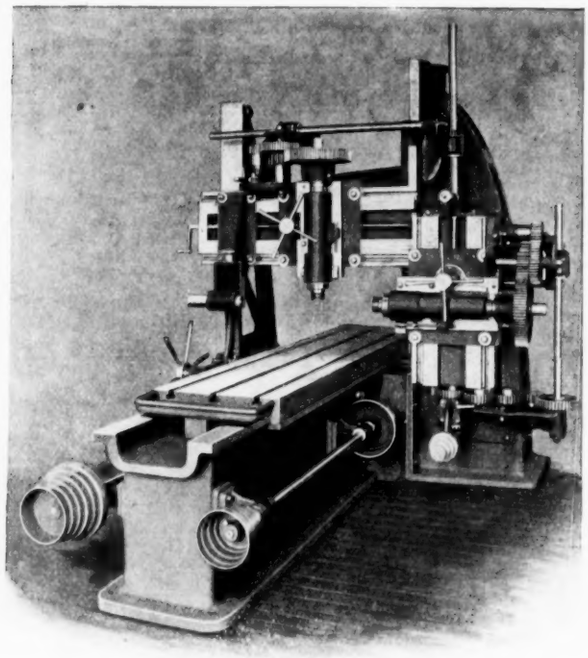
The Metropolitan Electric Construction Company, of New York, has been incorporated. B. Chandler, Ed. H. Johnson and Herbert T. Jennings, of New York, are among the directors.

The Jordan & Kelly Company, of Syracuse, N. Y., has been incorporated to manufacture boot and shoe machinery. James Jordan, John A. Kelly and Daniel F. Cushman are among the directors.

Articles of incorporation of the Hightstown (N. J.) Electric Light & Power Company have been filed. It is the intention to erect a plant at Hightstown and supply surrounding places with light, heat and power.

The Miller-Ware Automatic Heating Company, of Buffalo, N. Y., has been incorporated. Among the directors for the first year are W. F. Miller, Pittsburg, Pa.; J. C. Williams, Buffalo; E. R. Ware, Worcester, Mass., and S. J. Douglass, East Aurora, N. Y.

The Weber Gas & Gasoline Engine Company, of Kansas City, Mo., has just finished a new addition to its factory. The new addition contains the testing department, finishing department and offices. By moving the testing department its main machine shop floor has been relieved, and much space given for additional tools, increasing the capacity of the plant about 30 per cent.



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Index to Advertisers.

	PAGE
Acme Machinery Co.	20
Acme Malleable Iron Works	54
Albro Clem Elevator Co.	51
Almond, T. R.	2
Alteneder & Son, Theo.	54
American Engine Co.	54
American Gas Furnace Co.	2
Armstrong Bros. Tool Co.	45
Armstrong Mfg. Co.	50
Backus Water Motor Co.	9
Baird & Co., Henry Carey	45
Baird Machinery Co., U.	11
Baker Bros.	4
Barnes Co., W. F. & John	46
Beaman & Smith	9
Bement, Miles & Co.	5
Bentel & Margedant Co., The	42
Berlin Iron Bridge Co.	55
Besley & Co., Chas. H.	56
Bethlehem Foundry & Machine Co.	10
Bickford Drill & Tool Co.	47
Bickford, H.	56
Bignall & Keeler Mfg. Co.	51
Bilgram, Hugo	4
Billings & Spencer Co.	45
Blaisdell & Co., P.	10
Bliss Co., E. W.	50
Boston Gear Works	45
Bowsher Co., N. P.	3
Bradford Belting Co.	17
Bradford Mill Co., The	16
Brainard Milling Machine Co.	14
Bristol Co.	56
Brown & Sharpe Mfg. Co.	56
Buck Bros.	40
Buffalo Forge Co.	1 and 56
Builders' Iron Foundry	11
Bullard Machine Tool Co.	15
Bunker Hill Mfg. Co.	12
Burr Mfg. Co.	45
Carborundum Co., The	4
C & C Electric Co.	16
Chadwick & Co., G. B.	45
Cincinnati Milling Machine Co.	50
Cincinnati Screw & Tap Co.	20
Clayton Air Compressor Works	20
Cleveland Machine Screw Co.	4
Cleveland Stone Co.	55
Cleveland Twist Drill Co.	56
Clough, R. M.	3
Colcord & Sanderson	17
Columbia University	44
Columbus Engineering Co.	43
Comstock, Wm. T.	50
Cook Co., Asa S.	50
Crescent Steel Co.	8
Curtis & Curtis	4
Cushman Chuck Co.	3
Dallett & Co., Thos. H.	51
Davis & Egan Machine Tool Co.	53
Dayton Gas Engine & Mfg. Co.	54
Detrick & Harvey Machine Co.	10
Diamond Machine Co.	8
Dixon Crucible Co., Joseph	4 and 8
Doan & Co., J. B.	17
Dreses, Mueller & Co.	19
Eames Co., G. T.	8
Errington, F. A.	3
Evans Friction Cone Co.	50
Fay & Scott	19
Ferracute Machine Co.	42
Fifield Tool Co.	56
Flather & Co.	50
Foos Gas Engine Co.	54
Fortune, Robt.	43
Foster, Walter H.	50
Frasse Co.	19
Frick Co., The	54
Frontier Iron Works	54
Fuel Economizer Co., The	12
Garvin Machine Co., The	15
Geometric Drill Co.	18
Gisholt Machine Co.	44
Gleason Tool Co.	20
Goodyear, S. W.	4
Gould & Eberhardt	20
Grant Gear Works	20
Gray Co., G. A.	20
Greenfield, W. G. & G.	54
Hampden Corundum Wheel Co.	3
Harlow & Co., C. F.	42
Harrington & King Perforating Co.	56
Harrington & Son Co., E.	8
Hartford Steam Boiler Insp. & Ins. Co.	44
Henderer's Sons, A. L.	44
Hendey Machine Co.	41
Henley & Co., N. W.	40
Hess, Henry	40
Hill, Clarke & Co., Boston, Mass.	7 and 17
Hill, Clarke & Co., Chicago, Ill.	17
Hill Tool Co., Hugh	19
Hilles & Jones Co.	16
Hjorth, B. R.	19
Hoggson & Pettis Mfg. Co.	3
Hoppes Mfg. Co.	8
Horton & Son Co., E.	3
Hurlbut-Rogers Machine Co.	3
Hyatt Roller Bearing Co.	2
Ingersoll Milling Machine Co.	43
Ingersoll-Sergeant Drill Co.	14
International Correspondence Schools	45
Jenkins Bros.	43
Jessop & Sons, Wm.	4
Jones & Co., B. M.	11
Jones & Lamson Machine Co.	20
Kelly Machine Co., R. A.	51
Kempsmith Machine Tool Co.	12
Keuffel & Esser Co.	12
Kling Bros.	54
Landis Tool Co.	44
Le Blond, R. K.	50
Le Count, Wm. G.	3
Lodge & Shipley Machine Tool Co.	52
Long & Alstatter Co.	4
Mass. Charitable Mechanic Association	42
Maris Bros.	11
McCabe, J. J.	7 and 17
McVicar & Sweet	47
Mergenthaler & Co., Ott	51
Merrell Mfg. Co.	16
Mianus Electric Co.	17
Mietz & Weiss	54
Mitts & Merrill	11
Moline Elevator Co.	8
Morse Twist Drill & Machine Co.	19
Morse, Williams & Co.	16
Mossberg & Granville Mfg. Co.	49
Mosse, Rudolf	40
Newark Machine Tool Co.	3
New Era Iron Works	54
New Haven Mfg. Co.	18
Newton Mach. Tool Works, Inc.	51
Nicholson File Co.	12
Niles Tool Works	20
Niles Tool Works Co., New York Branch	17
Norton Emery Wheel Co.	16
Osterlein, W.	10
Otto Gas Engine Works	54
Page's Sons, Isaiah	40
Pawling & Harnischfeger	20
Pearson Machine Co.	56
Philadelphia Book Co.	51
Philadelphia Bourse	55
Phosphor Bronze Smelting Co., Ltd.	10
Pond Mach. Co., L. W.	6
Poole & Son Co., R.	8
Pope Tube Co.	46
Powell Planer Co.	44
Pratt Chuck Co.	3
Pratt & Whitney Co.	43
Prentice Bros.	7
Prentiss Tool & Supply Co.	17
Q & C Co.	42
Quint, A. D.	51
Rahn & Mayer	45
Rand Drill Co.	54
Reed Co., F. E.	45
Reed Mfg. Co.	40
Reeves Pulley Co.	51
Reinecker, J. E.	10
Rogers Boat Gauge & Drill Wks., John.	11
Roots & Co., P. H. & F. M.	54
Rue Mfg. Co.	54
Sackman, F. A.	44
Safety Emery Wheel Co.	11
Saunders' Sons, D.	8
Sebastian Lathe Co.	43
Sellers & Co., Inc., Wm.	20
Seneca Falls Mfg. Co.	42
Sessions Foundry Co.	12
Shriver & Co., T.	51
Shultz Belting Co.	20
Sibley & Ware	16
Skinner Chuck Co.	3
Slocomb & Co., J. T.	19
Smith & Mills	4
Spencer Auto. Machine Screw Co.	5
Sperry Engineering Co.	54
Spon & Chamberlain	43
Spooner & Hall	2
Springfield Gas Engine Co., The	54
Springfield Machine Tool Co.	14
Standard Tool Co.	56
Starrett Co., L. S.	8
Stiles Press Co., E. S.	4
Stover Novelty Works	4
Strelinger & Co., Chas. A.	2
Stuart's Foundry & Machine Works, R. J.	56
Syracuse Twist Drill Co.	54
Tight Joint Co.	2
Timolat, J. G.	55
Toledo Machine & Tool Co.	3
Toomey, Frank	17
Trump Bros. Machine Co.	3
Turner, Vaughn & Taylor Co.	3
T. & B. Tool Co.	20
U. S. Metallic Packing Co.	47
Wais & Roos Punch & Shear Co.	8
Walcott & Son, Geo. D.	8
Walker Co.	12
Walker, John	11
Waltham Watch Tool Co.	50
Warner & Swasey	56
Watkins Co., F. M.	54
Watson-Stillman Co., The	48
Weber Gas & Gasoline Engine Co.	54
Webster Mfg. Co.	54
Webster Co., Warren	54
Webster & Perks Tool Co.	11
Wells Bros. & Co.	16
Westinghouse Elec. Mfg. Co.	14
Whitcomb Mfg. Co.	51
Whitney Mfg. Co.	9
Whiton Machine Co., D. E.	3
Wiley & Sons, John	43
Wiley & Russell Mfg. Co.	43
Williams, White & Co.	51
Woodward & Rogers	17
Worcester Machine Screw Co.	4
Wyke & Co., J.	45
Wyman & Gordon	56

Contents.

	PAGE
Lighting a Pumping Station by Water Power	21
England's Competitors	22
Frictional Losses in a Hydraulic Intensifier. By Walter Ferris	22
Compressed Air Explosions.—A Recent Typical Explosion. By Frank Richards	24
Universal Sawing Machine	25
Shop-Eye-Doctors' Tools	25
Accurate Screw Machine Work.—Screw Cutting. By J. O. Surface	26
The Centigrade Thermometer	27
Screw Cutting Device for Any Pitch.	28
British Engineering Trade	28
A Handy Pipe Wrench	29
Some Bills Before Congress	29
Letters from Practical Men: Prevention of Halation in Shop Photographs. By Brioschi, Finzi & Co. ....Diameter and Pitch of Worms. By C. F. Williams....A Counterbore. By W. A. Gowen....Fly-Wheels in Electric Power Stations. By A. Bollinckx....Chains and Chainless Wheels. By Harris Tabor....Percentages of Efficiency. By Tecumseh Swift....A Constant Jig for the Drill. By Morris Fulton....Pure Pig Iron. By Sam'l Webber.....Commutator Construction. By L. C. Sharp....Roots by Logarithms Having Negative Characteristics. By C. H. Stoddard....Broken Steam Pipes. By Eugene Lothrer....New Caliper. By R. W. J. Stewart....The Air Cushion for Elevators. By Steady Rest....Another Piston Pattern. By Wm. Pilton	29-34
Foreign News Notes. By A. F. Tennille	34
A Year's British Exports of Machinery	35
Work of the Manuscript Factory	35
A Nonagenarian Mechanic with a History	35
American Draftsmen	35
The Reproach of Ignorance	36
A Government Swindle	36
Questions and Answers	36
The Strike-Lockout Settlement	37
The Third Annual Convention of the National Association of Manufacturers	37
Obituary	38
Founders' Association	38
Personal	38
Inquiries for Machinery	39
Technical Books	39
England and Belgium, "the Great," etc	39
Commercial Review	40

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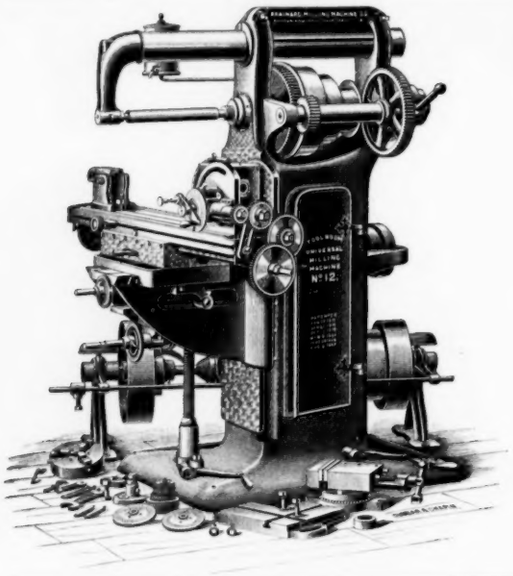

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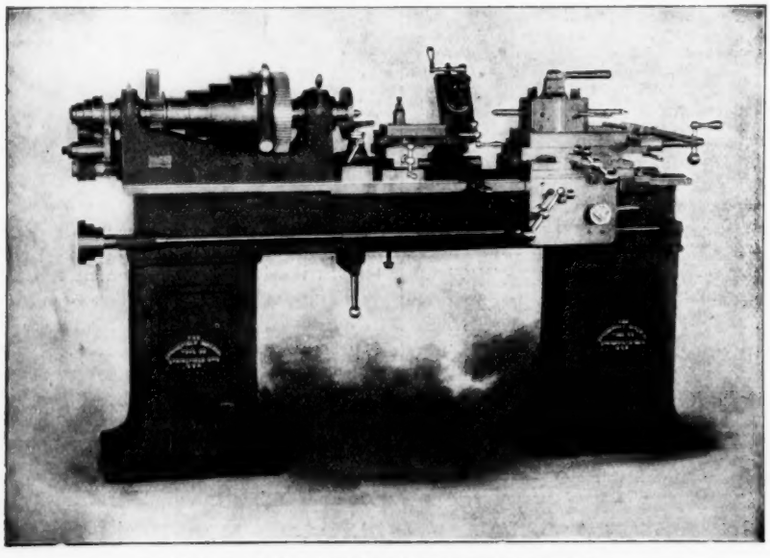

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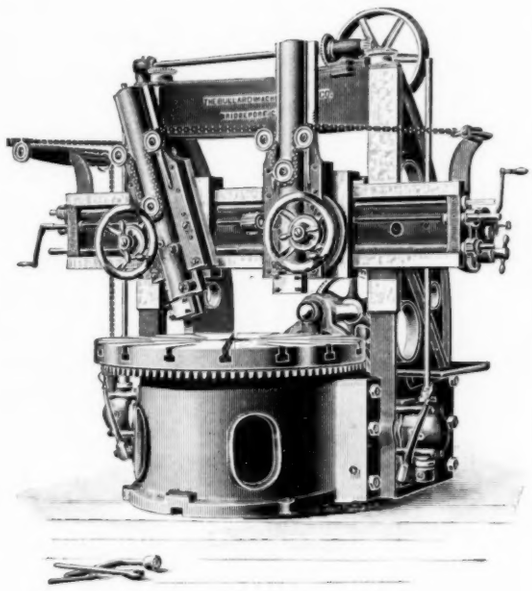

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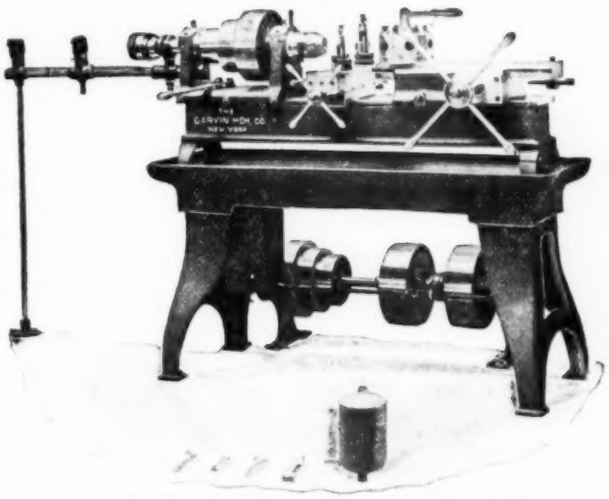

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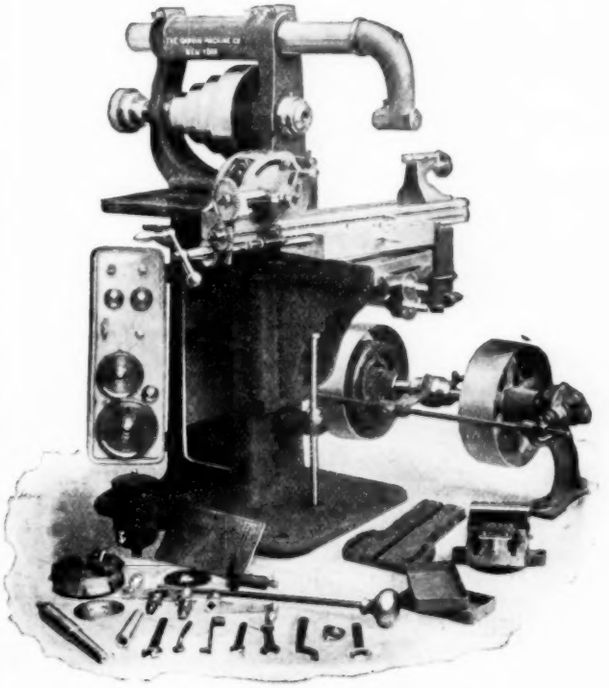

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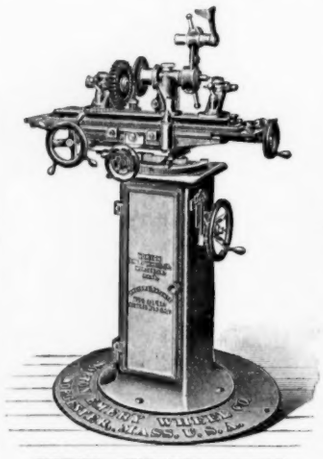

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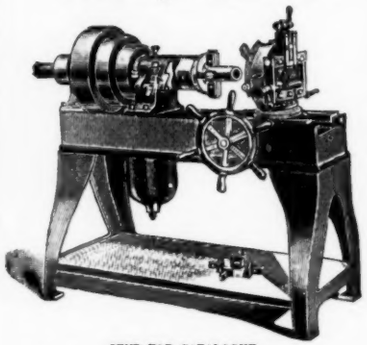

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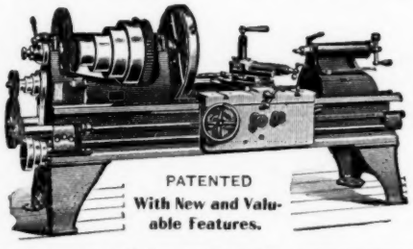

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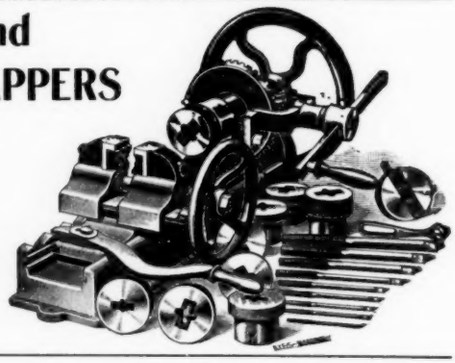

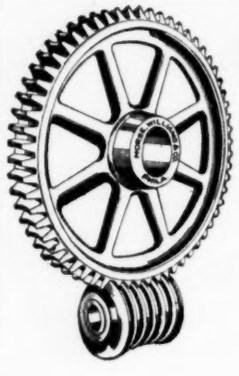

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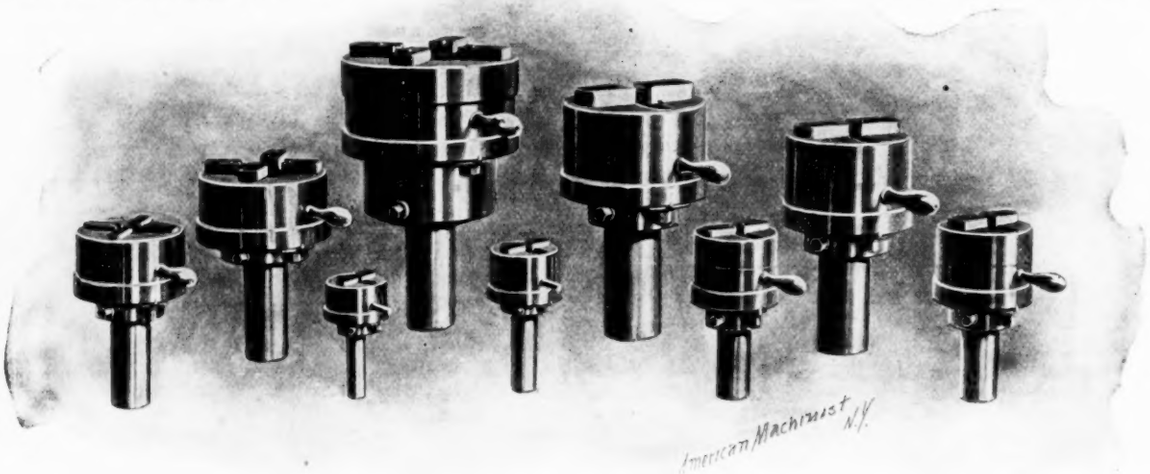

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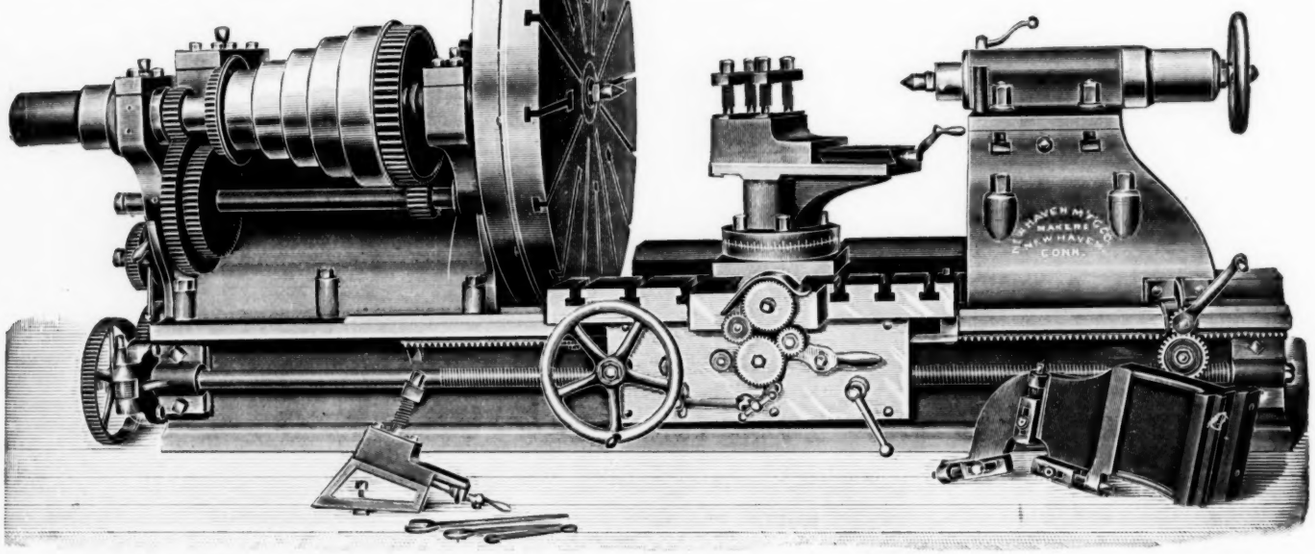

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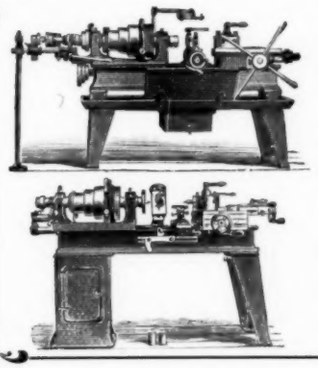

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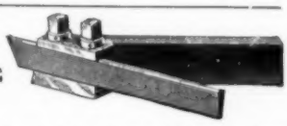

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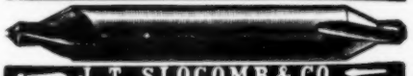

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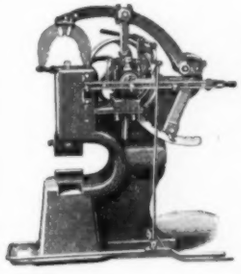

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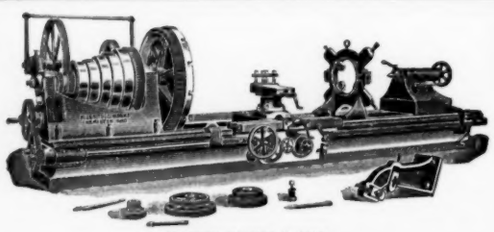

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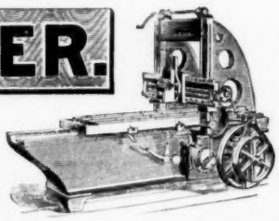

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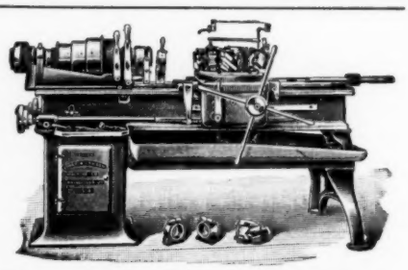

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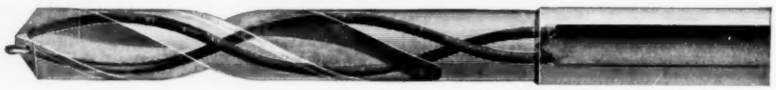

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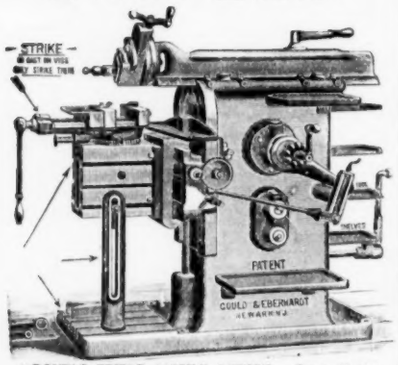

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